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KONGL. SVENSKA VETENSKAPS-AKADEMIENS HANDLINGAR. Bandet 32. N:o 1.

REMARKS

ON

THE HELIOLITIDÆ

BY

G. LINDSTRÖM

WITH TWELVE PLATES

COMMUNICATED TO THE R. SWEDISH ACADEMY OF SCIENCES, OCTOBER 12TH 1898

STOCKHOLM
KUNGL. BOKTRYCKERIET. P. A. NORSTEDT & SÖNER
1899

NOV 30 1900

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ERRATA.

Page	11	line	18	from top,	The statement concerning the aculæ is rather to be corrected by what is said at page 87 in description of Plasmopora? reticulata.		
»	37	»	12	»	for	*Subfamily*	read *Family*.
»	41	»	6	»	»	1819	» 1818.
»	41	»	18	from bottom	»	*macrostylis*	» *macrostylus*.
»	41	»	18	»	»	133	» 135.
»	54	»	8	from top	»	1833	» 1834.
»	60	»	5	from bottom	»	*interstinctus*	» *intricatus*.
»	70	»	12	from top	»	family	» tribe.
»	70	»	18	»	»	1861	» 1867.
»	93	»	6	»	»	1819	» 1818.

The printing of this memoir was commenced January 24th and finished April 20th 1899. When the thirteenth sheet was ready to be printed, April 7th, I received a work written by Dr KIÆR, partly treating of the same subject and then just published.

Introduction.

The purport of this memoir is chiefly to review the Swedish species belonging to the palæozoic corals of the family of the Heliolitidæ, also paying due attention to several species from other regions, which give good illustrations of the structure and the development. To the genuine Heliolitidæ I append the Coccoseridæ, which in some instances have been described as Heliolitæ and which I consider to be a group nearly related to them.

The material for attaining this scope has been derived chiefly from the island of Gotland, being very rich in such fossils, but also from other places in the mainland of Sweden, as well as from all other countries where Silurian and Devonian formations exist, excepting Australia.

My thanks are due to many naturalists, some now deceased, for valuable contributions to my work, through sending me with great liberality specimens and much useful information. I am thus under great obligations to Signor G. de Angelis D'Ossat in Rome, to the late Mr Billings, Professors Douvillé, Frech, Mr J. E. Gray, late of Hagley, Dr J. W. Gregory, the late Dr J. Hall of Albany, Drs Head (Chicago), Hinde, Holm, Professors Ths. M'Kenny Hughes, Inostranzew, von Koch, von Koenen, Laube, Malaise, Alph. Milne-Edwards, Nicholson, M. D. Oehlert, Dr Penecke, Prof. Počta in Prag, Prof. Ferd. Roemer, Dr Rominger, Prof. Schlüter, Akadem. Fr. Schmidt, Prof. Hj. Théel, Drs Törnquist, Wentzel, Wiman, and H. Woodward.

It has been the more welcome to receive such friendly assistance as the identification of many species is very difficult through unsatisfactory descriptions and bad or incomplete figures. Through the scients above mentioned I have received for inspection several critical specimens which have formed the basis for descriptions by previous authors. It is, of course, most important to examine such specimens and compare them with others because there may, especially in respect to the oldest descriptions, be some uncertainty of what forms were kept in view.

With very few exceptions, especially mentioned, a great number of specimens have in each species been examined, in some instances more than hundred, and studied in transparent sections.

The state of conservation of the specimens is naturally of the utmost importance. The originally calcareous coralla have in some strata been silicified and consequently their structure is often totally lost or destroyed. But even in those which have retained the calcareous constitution it happens that the older portions have been subject to chemical transformations during their long enclosure in the rocky strata, and the sceletal elements been, as it were, blotted out during that long enduring process. The aspect of the septa and the outlines of the calicles are blurred and evanescent. Such specimens would be highly misleading if more perfect specimens were not at hand. But even in well preserved specimens there may sometimes be features and structures, which can be in a certain way described, but, at present at least, baffle all attempts to declare or explain their real meaning, as for instance what has been called the formation of fasciæ in certain Heliolitæ.

Generally specimens found in situ are well preserved, especially in limestone or marly strata, those, again which are found detached on the shores or on the fields, derived or *remaniés* from older strata are more or less altered, silicified, changed into dolomite and weathered.

In a great number of specimens it is almost impossible by the exterior appearance to distinguish the species from each other. Apparent similarity of the surface may hide the greatest dissimilarity of the interior structure. No true knowledge of these corals can be gained without sections in thin, transparent slices, transverse and longitudinal, and chiefly such will give the best results. Tangential ones are also sometimes of value. In some instances it is quite necessary to take a series of many sections along the same line at different depths, as for instance in order to gain a true insight into the phases of the gemmation.

It is in the deciphering of these microscopic objects of importance not to be deceived by false appearances, caused by strange infiltered inorganic matter, by diminutive crystals of manganous or ferric oxide hydrate or of arragonite etc. in dispersed individuals or heaped in druses. Below, in the special descriptions, instances will be given how such extraneous matter has been mistaken for sceletal structures and described as such.

Owing to the great plasticity of these, as well as of so many other corals, it is extremely difficult to draw neatly the lines of distinction between the different species, as they seem to be, as it were, confluent with each other and combined by numerous gradations in character. In the descriptions of supposed new species too much stress has been laid upon the size of the calicles, their distance from each other or the amount of the interposed coenenchyma, as being characteristic differences. But who ever has examined a great number of specimens soon has been aware that such characters are of very little value, if any, as large and small calicles may often be found placed at much varying distance from each other on the same colony. In one specimen of Heliol. interstinctus, for instance, the calicles vary in size from 1 mm. to 0,5 mm. Of widely greater importance not only for specific, but even for generic differentiation are such sceletal elements as the septa, their shape and size, the structure of the coenenchyma, and the dissepiments as seen in longitudinal and transverse sections. The manner in which the coral has grown may sometimes be of value, especially for singling out local varieties.

In the following I have given, first an account of the general structure of the whole family, which being thus ascertained, serves as a basis for secondly to eliminate all those heterogenous fossils, corals and bryozoa, which have for so long time been, according to my opinion, wrongly associated with the Heliolitidæ. Next I shall give a notice of the geographical and geological distribution. At last these introductory remarks are followed by the detailed descriptions of all genera and species which I have been able to examine.

In respect to that encumbrance which is called »List of synonyms», I have tried to make it as complete as possible. I have, however, excluded »*nomina nuda*», or mere catalogue names, unaccompanied by descriptions, comments or figures, unless being quite sure of the identity, as for instance in regard to Swedish species, through examination of specimens or by reliable references. Even if an author has identified his specimens with previously decribed species, there is no certainty of the validity of this determination, unless there has been made by him a thorough research of the original specimens. Hence it is necessary to accept a great many synonyms with caution and reserve.

At last I may be permitted to express my deep gratitude to the Royal Swedish Academy af Sciences for defraying the expenses of publishing this memoir. I have also to tender my thanks to Herr G. Liljevall, who with the utmost care and with his well known artistic skill has drawn the plurality of the figures placed on the annexed plates, and given me much valuable assistance in preparing specimens and in clearing up some obscure features of structure. I am, however, afraid that the manner of the reproduction of his drawings is not, at least in some instances, doing full justice to them.

Remarks upon the general Structure of the Heliolitidæ.

The coenenchyma is the most prominent feature of the Heliolitidæ. Numerous are the names which have been bestowed upon that part of the composed corallum in this family and others, and quite as much varied have been the interpretations concerning its true nature.

Linnæus spoke about »pori minimi» between »pori magni», Hisinger says »massa porosa cellulis interjecta», James Hall »spaces between the openings», Dana »interstitial space», Phillips »intervalls filled by polygonal openings», M'Coy »polygonal tubes», Lonsdale »interstices» or »interstitia porosa». German authors as Schlottheim say »Zwischenräume», Quenstedt »Zwischenmasse» or »Grundmasse», Vogt »Zwischensubstanz», and most recently von Koch »Zwischengewebe».

In this state of an unstable and ever changing terminology, it was most welcome, when Milne-Edwards and Haime in their grand works on the structure of the Corals put an end to the confusion by giving the questionable structure a new definition and denomination. In their first memoir [1] they have called it peritheca. Identical is probably also the »tissu commun des Astrées» which they called »exothèque [2]. The term »coenenchyma» appears for the first time in their monographic descriptions of the Astræidæ [3]. It is there stated that »ces côtes réunies entre elles par des traverses nombreuses, forment tout autour de la muraille des divers individus une masse celluleuse plus ou moins épaisse, d'où résulte un coenenchyme [4] ou tissu commun dont le développement est souvent très-considérable».

The best definition is that given by the same authors in the »Introduction to the British Fossil Corals» (1850 p. vi). It is according to them the calcified derm which extends »exteriorly without constituting distinct costæ, and forms a dense or reticulate tissue, which in certain aggregate corals, is nowhere referable to any individual polyp and produces a sort of intermediate mass or true coenenchyma». Intercostal dissepiments also assume »the appearance of a coenenchyma, or common tissue».

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[1] Ann. Sci. Nat. Zool. 3:e Série, vol. IX, p. 49.
[2] l. c. p. 84.
[3] Ann. Sci. Nat. 3:e Série, X, p. 213. 1848.
[4] Derived from κοίνος, common, and ἔγχυμα, properly somewhat that is poured out into something, but here meant as an expansion or effluence.

By the latter passage, compared with the former statement, and also by others in their works may be seen that they had in view different sorts of coenenchyma, so amongst others a false one or a peritheca as in Galaxea, with which also the perithecal secretions in the palæozoic genera Syringophyllum and Pholidophyllum may be compared.

Since MILNE EDWARDS and HAIME had published their memoirs on the structure of the corals the term coenenchyma was almost generally accepted by authors writing on Anthozoa. But there has, of course, been great difference of opinion concerning its nature and some have even interpreted it in a sense contrary to the meaning of those first authors. In all variance of opinion is to be found a tendency to regard as coenenchyma all interspace between not too closely set calicles. In this wide conception it is, of course, evident that the denomination coenenchyma must embrace a great multiplicity of highly different structures. The coenenchyma in the Antipatharia cannot of necessity bear the slightest resemblance to that of the Madreporaria. It may then be justly said that it exists as many kinds of coenenchyma as there exist groups or large divisions of genera. DUNCAN[1] was right when he said that all sceletal structures outside the true theca were to be called exotheca, but when he continues that this was of two kinds 1) coenenchyma and 2) peritheca, a difficulty arises to discern between them. It might be said that the peritheca is without any intimate connection with the calicles, lies outside them, as in Galaxea, the coenenchyma again is in intimate connection with the calicles or indeed only a part of them.

As to the coenenchyma of the Heliolitidæ, the particular objects of this my memoir, the following most important interpretations of its nature have hitherto been given. One of the most remarkable opinions is that advanced by NICHOLSON. Probably the singular tubular composition of the coenenchyma in the genus Heliolites has given the first impulse to his views.

The first origin of this hypothesis can be traced to a paper, read by him[2] March 1875 and published in the same year. He there, treating of the calicles and the coenenchymal tubes of the genus Heliolites and its palæozoic allies says that »the question arises .... whether these (coenenchymal) tubuli are to be regarded as constituting a proper coenenchyma, or whether they are not really of the nature of aborted or rudimentary corallites». And he thinks that several facts not nearer mentioned favour the latter view. Not long afterwards MOSELEY sent to the Royal Society a paper on Heliopora[3] in which he expressed nearly the same opinion, without, of course, being aware of NICHOLSON's shortly before published views. In this paper MOSELEY compares the polyp animals of Heliopora with those of Sarcophyton, in which Alcyonarian there exists a dimorphism of two different sets of polyps: sexual animals and zooids, which latter are by far more numerous than the former. MOSELEY thought[4] it »by no means improbable that the coenenchym

[1] Revision p. 202.

[2] On the mode of growth and increase amongst the Corals of the Palæozoic Period. Transact. R. Soc. Edinb. vol. XXVII pt. III, p. 248.

[3] Structure and Relations of the Alcyonarian Heliopora coerulea etc. receivd by the R. Soc. Sept. 28th, read Novemb. 25th 1875 and published 1876 in vol. 166 pt. 1 of Trans. R. Soc. This paper was published again, a little enlarged, in the »Report on the Corals» in the »Results of the Challenger Expedition, Zoology» pt. VII of vol. II.

[4] l. c. p. 119.

here (in Heliopora) is composed of the tubes of absorbed polyps and zooids». Accepting the affinity of the Heliolitidæ with Heliopora, as given by MILNE EDWARDS, MOSELEY concluded, that all Tabulata were Alcyonarian and consequently that the Heliolitidæ were dimorphic. The contents of this first memoir was in the main reproduced in the Challenger Report. He there[1] proposed the terms »autozooids» for the sexual polyps and »siphonozooids» for KÖLLIKER's zooids. These suggestions of MOSELEY were eagerly accepted by NICHOLSON, who 1878 in his »Silurian Fossils of Girvan»[2] says: »In view of the researches of MOSELEY upon Heliopora we shall consider the smaller tubes (in the coenenchyma) to be really of the nature of corallites, tenanted, probably, in the living condition by a peculiar kind of zooids». In his work on the Tabulata (1879) he calls the different sets larger and smaller corallites and he changed later[3] these terms in accordance with MOSELEY into Autozooids and Siphonozooids of which the former correspond with what I would call the interior area of the calicles and the latter with the coenenchymal tubuli. In this respect a few authors, as WAAGEN, SARDESON and the anonymous translator of ZITTEL's Text-book in English, have followed NICHOLSON. I shall revert to this below.

Of the latest authors WENTZEL is almost the only one who has paid some closer attention to the structure of the Heliolitidean coenenchyma[4]. He in the main accepts my views as published several years ago and establishes two types af coenenchyma, of which he calls one, my vesicular coenenchyma, for costal coenenchym and the second which he does not distinguish by a separate name is identical with my tubular coenenchyma. One of the conclusions to which he has arrived[5] is, that the coenenchymal tubuli are not to be considered as a peculiar structure, independant of the septa, but as originated through their furcation, coalition and again repeated furcation.[6]

The Heliolitidæ display in the most evident manner the two elements out of which the sceleton in most corals is constructed, the vertical and the horizontal. The vertical element reveals itself as theca, septa with septal spines, tubuli and various detached formations in the coenenchyma; the horizontal element again is observed as tabulæ and various other sorts of dissepiment. Out of variations of both these elements the coenenchyma is composed.[7] In the Heliolitidæ together with the Coccoseridæ it is of essentially four different kinds. These are 1) the tubular coenenchyma, 2) the vesicular, 3) the bacular and 4) the compact coenenchyma.

1. The **tubular** coenenchyma which prevails in the genera Heliolites, Cosmiolithus and Proheliolites consists of narrow, mostly polygonal tubes enclosed within polyëdric thecæ and divided by regular horizontal tabulæ (dissepiments or traverses) more numerous or closely set than in the adjoining calicles. They increase by fission.

[1] p. 121.
[2] Pt. I, p. 53.
[3] Manual of Palæontology 3d Ed. 1889, p. 335.
[4] Zur Kenntniss der Zoantharia tabulata, 1895, pag. 3, 7—12.
[5] l. c. pag. 11.
[6] WEISSERMEL (Zeitschr. deutsch. Geol. Gesellsch. 1898, p. 56) has also treated of the sceletal parts and given good information.
[7] There is a decided difference in colour between the two kinds of elements when seen in transparent light; the vertical being pale straw-coloured, the horizontal black or grey, an outward difference, which may indicate some intimate difference in texture or chemical composition.

2. The **vesicular** coenenchyma is proper to the corals of the tribe Plasmoporinæ and is composed of a great number of thin, convex lamellæ, equivalent to the horizontal traverses or dissepiments of Heliolites. Through covering each other nearly as tiles they enclose an empty loculum below themselves and these locula become large or dwindling to microscopical littleness according to the much varying size of the lamellæ. In this same way a tissue is formed which also is common for so many corals belonging to widely different families or without any relation or affinity, as for instance Galaxea and Cystiphyllum. In its simplest and purest condition it appears in the genus Propora in such species as Pr. conferta (Pl. IX fig. 12, 18) and var. minima (Pl. IX fig. 24). Now, in others, there have arisen accessories of the vertical element, which are entirely wanting in the Proporæ just cited. In Propora tubulata, for instance, (Pl. VIII fig. 14) or still better in Plasmop. scita (Pl. VII fig. 8, 11) diminutive, vertical stylets sit on the superior surface of the convex lamellæ. I propose for them the term **aculæ** derived from **acula,** a little needle. No doubt they cover the whole surface, as can be learnt from the transverse sections (Pl. VIII fig. 12, 15) and the same are also scattered on the surface of the convex lamellæ in Pl. VIII fig. 8, 11, though looking more blunt, like wartlets, perhaps through weathering or not having grown out. They can be very irregularly distributed as in section pl. VIII fig. 19, often wanting and then reappearing. In Plasmopora? reticulata pl. VII fig. 36 they are no longer free and without connexion with each other, they have combined and form a reticulate web (fig. 35) giving the surface of the coral very much the appearance of the tubular coenenchyma. By this combination they have originated short tubuli intermingled with the convex laminæ.

These aculæ again are arranged in another fashion, having grown in longitudinal rows or series following exactly in the same line above each other as seen in Pl. VII fig. 10. There they are still without connection in a longitudinal direction, but in another specimen of the same species a junction is attained and the convex laminæ of the coenenchyma are, as it were, pierced by narrow rods or rather thecal elements, which somewhat disturb the formation or regular growth of the convex lamellæ that nevertheless tend to maintain their regular shape though they are pressed in between these rods and in shape approach the Heliolitidan horizontal tabulæ. What these strings really are, becomes evident on inspection of transverse sections as in pl. VII fig. 7, 9. They form a coenenchyma of irregular tubes, which, however, do not continue downwards, but are interrupted. Further modifications of this kind of coenenchyma, somewhat related to that of Heliolites, are described in detail under the different species of Plasmopora. It only rests to signify a coenenchymal formation peculiar to this genus. Around the calicle (Pl. XI fig. 36, 37) is placed an area formed of twelve radii or costæ, as they also may be named as they are a direct continuation of the septa, outside the calicular theca, and it might be said that the whole is a sort of reduplication of the calicle as these radii are linked together at their exterior ends through a sort of theca, being composed of angular lines of the vertical element which continue nearly uninterrupted downwards and in a longitudinal section are seen to encircle the calicular tube on all sides as a zone, broader than the irregular coenenchymal tube. I propose to call this fine structure **aureola,** which is entirely wanting in the other genera of the Plasmoporinæ. It may he somewhat difficult to find it so clear and evident in

all as in Plasm. stella, the species which shows it most perfectly. It may be larger than the diameter of the calicle and it may dwindle away to the smallest dimensions as in Plasm. heliolitoides, but upon closer inspection it may always be detected.

A different vertical structure occurs in the genus Propora. If sections as fig. 16, 17, 18 etc. pl. x are compared we find that amongst the coenenchymal lamellæ vertical rods are embedded, tapering at both ends, narrow, without any perceptible, microscopical structure. These rods may be named **bacilli** in contradistinction to another class, the **baculi,** about which further on. These bacilli are always solitary and do not unite, as seen in the transverse section of them (fig. 16, 17) where they stand out as black, widely separated points and their tops project above the natural surface of the corallum (fig. 12). The **baculi** again (pl. IX fig. 42, 44, 46, pl. x fig. 3, 4, 5) are stouter, short and have a distinct microscopical structure. They are, to wit, composed of diminutive fibrillæ, which stand out on all sides, directed upwards from a central axis, which in some is visible as a white line, but generally is wanting and really imaginary as these fibrillæ radiate from a common starting point which has no peculiar structure, being only the interior extremities of the fibrillæ. In longitudinal sections, where they are so common, they have a pinnate appearance, the fibrillæ standing out on both sides like the beard of a feather. They are dispersed among the convex lamellæ of the coenenchyma, remote from each other (pl. x fig. 5) and their superior ends project as tubercles on the surface of the coral (pl. x fig. 3). I am not prepared to say that these bacilli and baculi are to be considered as spicula, but it is evident that they share their intimate structure with the thecal and septal sceletons of the plurality of recent and fossil corals.

Amongst the Plasmoporinæ the genus Diploëpora occupies a peculiar position. In the oldest strata or in the youngest stages of growth the coenenchyma is of the distinctest vesicular nature, quite as in the most simple Proporas, consisting only of convex lamellæ. But during the continued growth of the polypary (Pl. XI fig. 4) this sort of coenenchyma is supplanted by a quite dissimilar one, a dense stratum of baculi, closely packed together and of the same pinnate structure as the solitary baculi just described. Though sharing for the rest all the particulars of the other Plasmoporinæ it really forms a transition to the next category of coenenchyma.

3. The **bacular** coenenchyma. The small tribe of the Coccoseridæ has its coenenchyma composed of baculi (Pl. XI f. 33, Pl. XII f. 6) also of the general pinnate structure.

4. The **compact** coenenchyma. In the genus Pycnolithus (Pl. XI fig. 8, 9) the coenenchyma is a dense, homogenous mass, a little granular, longitudinally permeated by white lines being vestiges of the replenished tubuli.

In order to demonstrate the development of the coenenchyma of Heliolites and to explain its nature I have had recourse to initial stages of colonies which have only a few millimeters in length. Also a peculiar manner of gemmation of calicles on the surface of the polyparies has given good information. I have as yet not succeeded in finding a single polypierite, just in its initial stage, but, as shown pl. I fig. 25, one sufficiently small incipient colony gives good idea of the first beginning. It consists of the initial polypierite and of two others which have budded out from the coenenchyma.

The initial or parent polypierite has a length of 0,6 millimeters from the tip to the upper edge of the calicle and also a diameter of 0,6 mm. of the calicle. It is cornet-shaped [1] gaining rapidly in width from the obtusely pointed apex and is with its whole length affixed to the theca of a rugose coral. A blackish, glossy epitheca covers the outside, finely transversally wrinkled. It is evident that this young polypierite besides the epitheca, if there is any, consists of a comparatively thick theca and that in the beginning there are no septa. This is quite in accordance with the development of other Silurian corals, as I have described elsewhere [2] and as I hope to describe more in full at another occasion. In these the sceleton also is an empty tube without any traces of septa, which appear only a little later one by one. When VON KOCH says [3] that the theca probably always develops out of the septa, which unite with their exterior ends, he apparently only had the recent corals in view, being not aware of the proceedings amongst the palæozoic ones.

The smallest specimen of Hel. interstinctus which I have found with septa was a little above one millimeter in length and had five septa developed on one side of the nearly circular outline (Pl. 1 fig. 30). The tabulæ, in the beginning much concave, are not seen until higher up in the tube (Pl. 1 fig. 28). By longitudinal sections and also by direct observation on such specimens as figured on Pl. 1 figs. 25—28, is seen that the coenenchyma is commencing to develop only when the young primary polyp has gained somewhat in length and after the first septa have been secreted. It is to be remarked that this reticulate tissue in its beginning never is formed on the exterior or upper side of the polypierite but always on the lower edge of the calicle — that side on which it during the first stage of growth is reposing, affixed to a substratum. After a while the coral has abandoned the rampant mode of growth and continues in an erect direction.

Further to elucidate the formation of the coenenchyma we have to contemplate a peculiar variety of calicinal gemmation, which occurs on the surface of mature colonies of Heliolites and other genera of the family. In the figures 34 I—IV pl. 1, a series of sections is represented from one and the same calicle of Heliol. interstinctus showing its gradual transformations, of which more in detail below. Suffice here to say, that out of the tubular calicle, which has raised itself above the coenenchyma, a new coenenchyma has grown around its theca and that this coenenchyma becomes also circumscribed by a theca so that in this stage the corallum has two thecas, one interior and one exterior theca. The exterior theca through the increasing growth of the polypary envelops at last a great number of calicles with their surrounding coenenchyma and coincides or is identical with the thin film which generally has been called epitheca, but for which I would rather propose the name **coenotheca** as it is the common integument or wall of all calicles in a compound Heliolitidean coral.

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[1] BERNARD, Journ. Linn. Soc. Zool. pt XXVI, 1898, p. 498, calls this initium of Alveopora an epithecal cup, but it is probable that this, like Heliolites and others, consists not only of epitheca but of several thin linings within the epitheca.

[2] Ueber die Gattung Prisciturben KUNTH 1889 Bihang. Vet. Akad. Handl., Bd 15 Afd. IV n:r 19 p. 4; and Beschreibung einiger Obersilurischen Korallen etc. 1896 p. 8, Taf. I fig. 9, 10, also p. 49, Taf. VIII fig. 110.

[3] Biol. Centralblatt IIr Bd p. 588.

By these two different modes of growth we learn, first that the calicle of a Heliolitidean does for some time exist without any coenenchyma and secondly that this structure is a secondary growth and developed either from one side of the initial polypierite or all around a calicle, which by rising as a tube above the parent coenenchyma introduces the intracalicinar gemmation and thus for a time exists as a portion of a solitary individual. Consequently it belongs not exclusively to a compound coral. It acquires its character of a coenenchyma only when it embraces more calicles than the first, when such have been produced by it through gemmation. Before this happens it is something else.

It can be shown that the perfect homology to it is found in corals which never form compound corals, but continue single through their life. The figure 25 pl. XII represents the calicle of a Thecopsammia enlarged. The exterior ends of the numerous septa are dissolved into the dense, spinous and porous tissue which like a broad frame surrounds them and the interior of the calicle. This outer zone has been called wall by DUNCAN but I think that it is a structure quite out of the category of a wall. It is in intimate connection with the septa and there is moreover outside this zone an epitheca or rather a thin wall, because there seems indeed to be no real difference between these two names and I do not think that any one has really seen an epitheca covering a theca, so as to make out the difference between the two in juxtaposition. The calicle of many corals, recent and fossil, belonging to widely distant families, is in the same manner as this Thecopsammia provided with a broad marginal, flat plane from which the septa radiate towards the centre of the calicle. I have formerly [1] called this expansion »Gebräme», which word may be rendered in English with *border* or border-zone. I can not decide whether it in some way is identical with the often employed term »Randplatte», but I should think that it is not.

In several corals, as the palæozoic Ptychophylla which resemble Fungia, the septa are considerably dilatated exteriorly and form one of the largest borders. In the »Perforates» the outer ends of the septa vanish in the border zone as in Thecopsammia and Balanophyllia. If now a solitary coral of such a growth increases in width and then propagates through gemmation, this latter procedure will take place on the border. A new calicle is budding out of this spongy, loose substratum, is surrounded by a quite similar porous border and when at last several calicles have become placed in the same way near each other, they coalesce with their borders to a common mass, in which the calicles project from the now fully developed coenenchyma. This consequently arises from the coalesced borders of the calicles. It is the same with the Heliolitidæ.

In the figure 26 pl. XII a young colony of a Turbinaria is delineated growing on the surface of a dead coral of the same species. It is evident that the larger calicle has sometime been alone, surrounded only by its reticulate and spiny border, out of which later, when expanded sidewards, a new calicle has budded.

To apply this to the coenenchyma of the Heliolitidæ let us recapitulate and finish the description of the structure of an individual polypierite in that family. Its component parts are enclosed within a solid, imperforated wall. There cannot be the least doubt that the theca is the first formed part and that it for a while alone constitutes the whole

[1] RICHTHOFEN's China, Bd 4, p. 59.

sceleton of the polyp. It is quite certain that in the majority of the palæozoic corals and chiefly amongst the Rugosa [1] the theca is secreted before any septa are formed. The same is the case in composite colonies of Heliolitidæ, for instance in Diploëpora, where young calicles just beginning to sprout forth from the coenenchyma on the top of the branches show a narrow, smooth edge forming the circular wall without the least traces of any septa. By and by there are formed faint infoldings in the margin, becoming more and more distinct and assuming the shape of well developed septa with spiny edges. Pl. x fig. 32—35.

There are true septa, in no way homologous with the pseudosepta of Heliopora. They are without exception always and constantly twelve. They may be more or less perfectly developed or even totally wanting in some varieties as Heliol. decipiens, though their presence in some calicles of the same specimen indicates that they may have been present in all, but have been absorbed. In the pl. II figs 3—6 an illustration is given of this condition from several closely set calicles on the same surface of a Heliolites. The calicle, fig. 3, with complete septa, meeting in the centre, is evidently one of the oldest, being smaller, next, fig. 4, one with somewhat lesser septa, then, fig. 5, one with mucb reduced septa like those common in Heliol. interstinctus and at last, fig. 6, a calicle, like the plurality of the other calicles on the same surface, without any septa at all and giving the characters of Heliol. decipiens.

In some species of the genus Heliolites there are septa of alternating size (pl. II f. 29, Hel. porosus), as if indicating a tendency to form two cycles of six septa each. But we have as yet no evidence that the six longer septa have originated earlier or prior to the shorter ones, nor does the development, at least as seen in the coenenchymal gemmation, confirm this supposition.

The shape of the septa varies much as to the different tribes. Common to them all is that they are thin laminæ, intimately composed of minute, microscopic fibrillæ directed upwards and inwards. Pl. II fig. 35, pl. III fig. 2. They have consequently quite the same microscopical structure as the septa of almost all other corals and even concordant with the structure of all other vertical elements both of the Heliolitæ and others. In a longitudinal section of Heliol. porosus (pl. II fig. 35) this is very distinctly seen, where a calicular theca meets a theca of a coenenchymal tube and between them the dark line, which Miss Ogilvie calls centre of calcification, but the true nature of which is not explained by her suggestions. Next we have two figures (pl. II fig. 34, pl. III fig. 1) of transverse sections representing parts of calicles with septa and coenenchymal tubes. Each tube has a theca well circumscribed through a dark line, dividing it from the surrounding thecas. The theca and the septa of the calicle are coherent as a whole and separated from the coenenchyma through the dark line. The true colour of this line, in

[1] There is no valid reason, as it seems to me, at least in the present provisional state of our knowledge of the fossil corals, to abandon this name for those corals, which later authors have called Tetracorallia or Pterocorallia. The former name is not borne up by the structure, as the arrangement of the septa according to four primary ones is visible only in a few species. The denomination Rugosa again is most characteristic pointing to one of the chief distinctions of this group. There exist in none of them costæ, but the exterior longitudinal foldings of the wall coupled with the peculiar initial stages of growth separates them from all posterior corals.

all fossil and recent corals known to me is white or creamcoloured and it looks black only when seen through transmitted light.

The septa consist of two moieties with fibres tending in different directions and a narrow whitish partition line. If it is borne in mind that in most palæozoic corals the septa are secreted later than the theca and by the evidence given by the transverse sections figs. 33—34 pl. II and figs. 1, 23 pl. III it seems that it must be concluded that the septa of the said corals are dependencies of the calicular theca and offshoots of it and not *vice versa* that the septa form the theca. The smallest septum seen in fig. 33 pl. II, is without dividing line and has particularly the appearance of having originated from the theca. Sections of the septa nearly resembling those on my plates have been figured by SARDESON (Tabulaten p. 267) and by WEISSERMEL (Zeitschr. deutsch. Geol. Ges. p. 61, 63 fig. 3 & 4.) The latter author has given valuable remarks on the structure of the Heliolitidæ, some of which coincide with mine.

On the interior edge of the septal laminæ spines of unequal size are often formed growing in the same direction as the elementary fibrillæ and probably owing their origin to lacunæ left in the tissue of the septal laminæ.

In the Plasmoporinæ the laminæ are much reduced and consist chiefly of a series of spines and when these, as often happens, have been destroyed the interior side of the calicle has a fluted appearance through the twelve narrow longitudinal ridges, which serve as the basis of the septa. In some species, as in Propora conferta, the septa have been invested with a multitude of microscopic crystals of infiltred manganous or ferric oxide hydrate giving them a false and deceptive appearance. Such crystals also cover the upper surface of the tabulæ in several corals as for instance in Propora conferta (pl. VIII fig. 34). It is in some instances difficult to decide whether one sees organic structures, as aculæ, or crystals.

The longitudinal angular curves of the theca which stand out between the infoldings of it, give to weathered calicles, which like those of »Lyellia», project free from the coenenchyma, an aspect like the rugæ on the outside of the Rugosa and like the rugæ they have also been called »costæ» or »pseudocostæ» by some authors. Their position in relation to the septa is perfectly the same as in the Rugosa, the septa alternating with these rugæ. It must he left as an open question whether this similarity is a sign of relationship between the two groups or not. These rugæ of the Heliolitinæ can not be confounded with true costæ, as such really occur amongst the Plasmoporinæ.

In the centre of the calicle of Heliolites interstinctus a columella is sometimes formed. It is an isolated narrow, twisted plate. It is, however, not constant, but may dissappear for a while and then again is formed anew. A longitudinal section (pl. I fig. 15, 23) shows such changes.

The size of the calicular areas varies between 4 millimeters and a little less than 0,5 millimeter. Their shallowness presupposes a very small amount of animal tissues to fill them and probably the living mass covering the whole sceleton has been very thin.

The dissepiment of the calicles consists in all genuine Heliolitidæ of horizontal tabulæ, regularly distantiated or more or less crowded, horizontal or concave, seldom interlaced or crossing each other. At their point of contact with the theca sometimes a

sort of septal grooves is formed, very small and shallow, nearly reminding of those which are seen in some Favositidæ (pl. IX fig. 4).

The genus Camptolithus makes it evident that the convex lamellæ of the coenenchyma in the Plasmoporinæ are identical with the tabulæ of the calicular tube, by showing how the remarkably convex tabulæ of the calicle of that genus are transformed into the same sort of convex lamellæ as in the coenenchyma (pl. X fig. 29, 30).

To complete the description of the different parts of a single polypierite, amongst the Heliolitidæ, we may only remind of the above described coenenchyma and how it in the beginning of its formation is a »border-zone» around the solitary calicle, as the case is in the intracalicinal gemmation. Here it must, however, be remarked that Thecopsammia and Turbinaria, above given as instances, have only one theca enclosing both the border-zone and calicle together.

Now this condition of two thecas in Heliolites is very much in analogy with what obtains in solitary polypierites of several other palæozoic corals for instance in the genus Acervularia where a central area is enclosed within an interior theca[1] and around this a flattened border-zone contains the septal ends and the interposed dissepiment. That interior wall is formed by dilatations of the sides of the septa, in such a way that the dilatations from contiguous septa meet and join, thus building up a well marked annular area, enclosing the central ends of the septa. The exterior theca or the theca proper which, although very thin, envelops every individual polypierite in a compound Acervularia, clearly indicates that the exterior area can by no means be considered as extracalicinal or as an exotheca, it is indeed an endothecal structure.

Besides Acervularia we find other corals with a similarly formed interior theca, as Pachyphyllum and Smithia, but in these there exists no exterior limitation or exterior theca between the different polypierites and where the septa of neighbouring calicles meet they are confluent without boundaries and consequently form a coenenchyma between the central areas of the calicles. It may be said that a coenenchyma originates as soon as in a compound coral all exterior thecas which else separate the polypierites in a colony, have vanished.

In Acervularia there is no coenenchyma, as we have seen, because every polypierite has its own exterior theca. In such genera again as Arachnophyllum, Pachyphyllum and Smithia and several others there is a true coenenchyma in the same conception as in Heliolites. In such genera the coenenchyma must be strictly regarded as endothecal or calicinal. What in Heliolites from the beginning was the calicle proper has by the exorbitant development of the border-zone become but the central area of the polypierite. It ought then properly be called the interior area of the calicle, when the surrounding coenenchyma is the exterior, but for conveniences sake I have in the descriptive part of this memoir retained the name of calicle to designate it.

Hinde has objected[2] to my views on the analogy between the »cylindrical corallite», as he says, in Heliolites and Acervularia. In the former, he writes, the wall is too distinct and well defined to be compared with the »pseudowalls» of Acervularia. This

[1] Muraille intérieure H. Milne-Edwards.
[2] Geol. Mag. 1883 p. 87.

objection aims only at relative distinctions, at a quantitative degree of development and does not affect the quality. The comparison can be held up, whatever the affinities of Heliolites may be. It is moreover very easy to find in longitudinal sections of Acervularia that the interior theca is more strongly built than that of Heliolites. HINDE also says that there is no evidence that the tubules in Heliolites are produced by the extension outwards of the ends of the septa of the coral. Not to forget the evidence given by the intracalicinal gemmation and the statements of WENTZEL above referred to nothing is more fit to prove that extension than the conditions in the Plasmoporinæ. In almost all species of Plasmopora, for instance Plasmopora stella, Pl. XI, fig. 36, the septa continue in the most distinct manner outside the interior theca as costæ and often, as also in Propora, join the septa or costæ from surrounding calicles.

The view that the coenenchyma of the Heliolitidæ is an endothecal structure, although no exterior theca for every single polypierite is developed in the compound corals, is strengthened by what follows. It is a most important fact, that in some Heliolitidæ the confines of the individual polypierites are most distinctly conspicuous, though the exterior theca is wanting. The figure (pl. VI, fig. 23) of Plasmopora calyculata may be consulted for this feature. There the coenenchyma is partitioned off into regular polyedric spaces through softly elevated ridges, also of coenenchymatous structure, thus forming well circumscribed calicular areas having the small central area (h. e. the calicle proper) with the inner theca in the middle and a portion of coenenchyma around it. In some of the Heliolitæ from Gotland faint traces of dividing lines are discernible on the coenenchyma. In another way, as in some specimens of Heliol. interstinctus (decipiens) pl. II fig. 11, the areas of the single polypierites are well seen as small cones separated from each other through shallow grooves. LONSDALE has described[1] specimens of »Porites pyriformis» (= Hel. porosus) figs 4, 4*a* with regularly circumscribed calicular areas. It is also possible that Palæopora? favosa M'COY figs 3*c*, 3*d* pl. 1C of »Palæozoic Fossils» represents a Heliolites with distinct calicular areas. These figures belong to another specimen than that figured on the same plate as figs 3, 3*a*—*b*, which represent the genuine Heliol. interstinctus. In SALTER's »Catalogue of the Cambridge Fossils» p. 104 a variety of a Heliolites is mentioned with »sunk pores» and also a »Heliol. variety with depressed areas at the cell mouths».

As a conclusion based on the above given statements and facts I cannot find how NICHOLSON's hypothesis of the dimorphism of the Heliolitidæ is to be upheld. I have attempted to demonstrate that the coenenchyma, strictly considered, is the integral part of every calicle in a compound coral, as is most evidently shown by Plasmopora calyculata and that Propora, the near affinity of which with other Heliolitidæ cannot be denied, has a coenenchyma which lends no support to the hypothesis of Siphonozooids. Still more convincing proofs of the impossibility of this hypothesis are given below in treating of the coenenchymal gemmation.

Modes of growth of the coralla. The composite corals are much variable as to their shape. In some species it is constant, in others again much depending on now

[1] Notes on the age of the limestones of South Devonshire, p. 721 of Transactions Geol. Soc. London, vol. V, 1840, pl. 58, fig. 4, 4*a*—*f*.

unknown local circumstances, thus giving origin to local varieties, but for the rest coinciding in essential characters with other specimens of the same species.

The most common forms are the *discoid* and the *hemisphærical*, more or less vaulted on the superior, corallite bearing surface and with a flat basis. Near to this is the *lamellar* colony, forming thin, incrusting or free plates, as in several of the Coccoseridæ. Then *sphæroidal*, *globular*, *sub-globular* and irregularly *globular*, *tuberose* colonies, these varieties bearing calicles on all sides, without any epitheca. A few are *dendroid* or *arborescent* with flatly compressed or tumid branches, as Diploëpora. There are also some *pyriform* or *mushroomlike* colonies. A peculiar manner of growth is remarked in several discoid species of Heliolites and especially amongst the Coccoseridæ: as it were, superimposed tiers growing in such a manner that a part of a colony has been arrested in growth, the other mass continuing to grow and spreading sideways covers the extinct part, leaving however a free space between.

The epitheca which is chiefly developed in discoid varieties, is a very thin, blackish, often glossy coating, grown in concentric rugosities and in some instances with a structure of its own as in Acantholithus.

The size of the polyparia or colonies is much variable. At the largest I have found specimens measuring 30 centims. in diameter; but generally they are smaller. Some may have grown much larger, as may be seen from fragments. In the strata of Stora Carlsö they lie in their natural position, as they once lived on the bottom of the Silurian Sea, with the flat epitheca as basis.

Propagation. It is evident that the small colonies, consisting of a primary polypierite with beginning coenenchyma, described above, must have led their origin from an ovum, which being developed into a free, swimming larva affixed itself and secreted a polypary.

The propagation through *gemmation* is by far more frequently observed. There are in the Heliolitidæ three different kinds of it, viz. 1. **Coenenchymal** gemmation. 2. **Intracalicinal** gemmation, and 3. **Epithecal** (or coenothecal) gemmation.

1. **Coenenchymal** *gemmation* (Pl. I fig. 32, I—IV, fig. 33, pl. II fig. 37, I—VII, pl. III fig. 27 I—IV, pl. V fig. 29 I—VII.)

The best instance of this has been found in Heliol. porosus, the procedure of which, as well as of other species, is given in detail further on in the descriptions. This procedure is by no means so schematically regular as Bourne has stated.[1] He says »that the constant number of twelve pseudosepta in Heliolites is the necessary result of the formation of the calicles by the suppression of a group of seven central coenenchymal tubes and the arrested growth of the adjacent walls of the twelve cells surrounding the group». But even if it were so, this is not valid for the Plasmoporinæ, where, and more so in Propora, no reduction can take place in the coenenchymal tubuli as such do not occur, at least not so pronounced as in Heliolites. In the Plasmoporinæ the twelve septa are entirely new structures formed out of the coenenchymal lamellæ, I suppose nearly in analogy with the gemmation in Galaxea. In a certain way there is reduction, but not

[1] Heliopora coerulea p. 463 pl. 11 fig. 9.

to that extent as BOURNE postulates. There is reduction *and* new growth. The septa are not a result from the arrested growth of twelve environing tubuli, but from the altered growth of the central tubuli and they are not formed all at once. In stage III there are seven and in stage IV nine. Moreover in Heliol. interstinctus there are only nine tubuli in the beginning partaking of the gemmation.

Most interesting and remarkable is to find in the same specimen of Hel. porosus the seven stages of the progress of the gemmation and side by side with it a fully developed calicle which is changing step for step in a quite opposite direction or decaying, dying out by being by degrees changed again into coenenchyma, out of which it had originated, in the same way as the budding new calicle beside it. The particulars are given in the description of Heliol. porosus.

If meeting with a calicle like the left one in section five (pl. II fig. 37) alone, without connection with any precedent or subsequent stage, it must indeed be very difficult, if not impossible to decide whether it is a calicle in progress or in regress, so nearly do both these changes resemble each other. We can consequently say that a Heliolitidean calicle originates from the coenenchyma but also in decaying returns to coenenchyma.

In a manner quite contrary to the generating agency, as a destructive one, the coenenchyma invades the calicles immersed in it. Through its exuberant growth it sometimes encroaches upon the calicles, covers them and kills them. (See pl. I fig. 20, 21.) The struggle between the coenenchyma and the calicle is to be seen in such longitudinal sections as figured on plate IX f. 24 or more strange on pl. X fig. 23, where, if I understand it rightly, calicles have been overwhelmed by the coenenchyma twice and new calicles grown up as many times. If it be so, it is a new and curious instance of the observations that a part of an organism can subdue and annihilate a more important and central part. Generally the coenenchyma has been regarded as something alien to the calicles, as without any connexion with them. But we now see them in a continuous intercourse, in reciprocal action, the coenenchyma is an outgrowth from the calicles and the calicles on the other hand bud out from the coenenchyma.

This kind of propagation forms one of the most serious objections which militate against accepting the hypothesis of dimorphism in the Heliolitidæ, so eagerly contended for by NICHOLSON and his followers. Long before 1883 when my observations on the coenenchymal gemmation were first published in abstract,[1] I had seen this mode of propagation in Heliolites and Plasmopora and already in 1876 the first figures representing this process were drawn. During the voyage of »Challenger» MOSELEY in 1875 discovered a similar mode of gemmation in Heliopora and his observations were published the following year.[2] He says that »new calicles are developed by the arrest of growth of one or more cells (= coenenchymal tubuli) . . . . which . . . . form a central floor in the calicle». The appertaining figure (pl. 9 f. 17), however, shows, as it seems, in the bottom of the calicle several *intact* coenenchymal tubuli. In turning to specimens of Heliopora to consult them in this case, it is very easily seen that the calicles originate from the

[1] Obersilurische Korallen von Tshau-Tiën, in RICHTHOFEN's China. Bd 4, p. 50.
[2] On the structure of the Alcyonarian Heliopora coerulea etc. p. 99 & 120 in Philos. Tr. R. Soc. 1876.

coenenchyma. There are small shallow pits in its mass, with some three or five tubes in the bottom, of which one or two are of more considerable size than the rest. There is, no doubt, arrested growth of a few as MOSELEY says, while the surrounding tubuli continue to grow upwards around them, and in Heliolites again there is continued growth and great changes in the bottom of the new calicle. In my paper I said that »aus diesem (the coenenchyma) knospen neue Kelche hervor .... indem der neue Kelch sich aus mehreren Coenenchymröhren ausbaut.» I was however not quite exact in saying that it went on in the manner described by MOSELEY nor is the illustration, which was given there of plate VII fig. 9 to the point, as it is questionable whether this is not rather a decaying calicle or one overwhelmed by coenenchymatous growth as above described. Instead I hope that the sections given on plate II of this memoir will be more convincing. If now, as NICHOLSON pretended, Heliolites is a dimorphous colony with sexual and asexual individuals and that the latter form the coenenchyma, the strange and abnormal fact would here prevail, that a new sexual individual is budding out from the body of as many as nine or more asexual individuals, which all build it up. Not to further speak of the paradoxical of such a supposition it is enough to remind, that there does not exist in the whole animal kingdom any instance at all, that a single individual is formed as a direct offspring from several others, the bodies of which entirely contribute to its formation.

In the same year as I published my views in RICHTHOFEN's China, though somewhat later, VON KOCH in his memoir »Ungeschlechtliche Vermehrung Palæozoischer Korallen» expresses himself very cautiously about this question and does not with a single word mention my observations on what he later calls »Cönenchymknospung». What he says[1] is: »Gegen diese Ansicht (NICHOLSON's) hat Lindström verschiedene Gründe geltend gemacht, von denen mir einer, die Entstehung eines Hauptkelches aus einer grösseren Anzahl von rudimentären Polypen, als der wichtigste erscheint». Now this is somewhat ambiguously expressed. The origin of a calicle from a great number of rudimentary polyps was not one of my reasons, on the contrary I contested NICHOLSON's views on the ground that it was impossible to accept such a supposition.

In the »Zoologischer Anzeiger vol. I p. 103, 1878 (not 1881 as VON KOCH himself wrongly writes in »Ungeschlechtl. Vermehrung» p. 10) in a paper, intitulated »Notiz über die Zooide von Pennatula» he says »Ich habe nun bei der Betrachtung einer Anzahl von Exemplaren der Gattung Pennatula die Bemerkung gemacht, dass sich manchmal einzelne dieser Zooide wie in jeder Beziehung normale Polypen entwickeln». This observation was, as we shall see, most welcome to the adherents of the hypothesis of dimorphismus in Heliolites and they did not care for, that VON KOCH himself in his paper[1] expressly had said that the circumstance that the Siphonozooids of the Pennatulids many times change into genuine polyps is an objection against the dimorphismus, and likewise also the anatomy of Heliopora.

WAAGEN, no doubt seeing the impossibility of reconciling the view of the dimorphismus, to which he adhered, with the observations on the coenenchymal gemmation tried

[1] Ungeschlechtl. Vermehrung p. 10.

to evade this dilemma by a suggestion[1] which he deduced from VON KOCH's above mentioned observation on the transformation of the siphonozooids and he was supported by NEUMAYR.[2] WAAGEN says that the siphonozooid in transforming into an autozooid required much more room and »it might then well be imagined . . . . that . . . to make room for the new individual thus formed, the surrounding siphonozoids die and that the first sign of this beginning decay is just the thickening of the outer walls, which are destined to form together the wall of the new autozooid». Does this mean that the tubuli around the new autozooid are absorbed and that only their outer walls remain to form the theca of the new calicle?

For the rest the thickening of the theca, of which WAAGEN speaks, is by no means the beginning of the change in the coenenchyma, but on the contrary the last act of it. And if it were as WAAGEN says, we should see only one of the »siphonozooids» enlarge and most naturally the central one within the area affected. Instead, the tubuli there continue for a while of the same size, and then it may be two or three contiguous ones in the periphery which have grown larger.[3]

At last NICHOLSON, who in his works previous to the third edition of his Manual of Palæontology, published in 1889, does not make any mention of the coenenchymal gemmation, seems there, p. 334, hesitate to accept fully the interpretation of MOSELEY of what may be called polygenesis as he says that the conversion of a group of imperfect polyps into a single polyp is a »remarkable» phenomenon. Then he continues in the same manner as WAAGEN, that it is only a single siphonozooid which becomes converted into an autozooid.

There is now not much need to confute these statements since BOURNE, VON KOCH and others have demonstrated that there are no siphonozooids existant in Heliopora. BOURNE has,[4] though assuming the affinity of Heliopora with Heliolites, shown, as it me seems, upon clear evidence, that the coenenchymal coeca of Heliopora »are not of the nature of degenerate siphonozooids». Consequently no single autozooid could here develop out of one, still less of a plurality siphonozooids. Moreover, on account of its sceleton Heliopora must be considered as a highly aberrant member of the Alcyonaria.

2. *Intracalicinal gemmation.* Of this I have above at page 13 given notice and below in the description of Heliol. interstinctus (pl. I fig. 34, 35 and also pl. IV f. 15, pl. VIII fig. 28) all particulars. In a certain way it is a variety of the coenenchymal gemmation, as no new buds arise before the coenenchyma has been sufficiently developed around the raised calicle. And both sorts of gemmation have the common feature of originating out of the border zone. Its difference from coenenchymal gemmation consists in its originating first a coenenchyma within the tubularly elongated calicle, then out of this new calicles.

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[1] Palæontologia Indica, Sect. XIII, Productus limestone Fossils p. 906.

[2] Thierstämme p. 331.

[3] I cannot find how my observation that the polypierite and the calicle proper in incipient colonies are formed before the coenenchyma can not the least, as WAAGEN seems to think, support a supposition of his that the coenenchymal tubes (= »mesopores») are the first and that the »large tubes» in Fistulipora are developed out of them. I did not occupy myself with the Fistuliporæ and the reality in Heliolitidæ is in direct contradiction to what he says.

[4] Structure and Affinities of Heliopora coerulea, 1895 p. 472—473.

3. *Epithecal* (or coenothecal) *gemmation.* As an indication of the propagating faculty of the epitheca I would consider such features as shown on pl. VII f. 11, pl. VIII f. 17, in which calicles go out directly from the epitheca on which they are based. The integument which once covered and secreted the epitheca, also through its vitality procreated independant calicles. These are as if truncated at their starting point and of the same width as the rest of the calicinal tube.

The natural limits of the Heliolitidæ.

Having in the preceding section characterized the Heliolitidæ I will now review such genera which by some authors have been from time to time ranked amongst them, stating my arguments for not considering them as members of this family of corals. In thus eliminating them from the Heliolitidæ I will examine these genera one by one, taking them in alphabetic order.

Great confusion has arisen because superficial analogies or presumed identity of quite different structures have been considered as homologies. Thus, to give one instance, Bryozoans like Monticulipora, Fistulipora and others, Favositidæ and several other corals have been stated to be nearly related to the Heliolitidæ or to belong to their family. It is necessary to bear in mind, that these form a well defined and clearly circumscribed group of fossils. Of very little value as a distinction are the tabulæ, these partitions which occur in widely different groups of animals. Cephalopoda, Gastropoda, Conularidæ, Annulata, Bryozoa and Foraminifera share this structure with the Corals. There are, however, slight variations, which make it possible to distinguish between the tabulæ of the Corals and those of the Bryozoa, of which particulars will be given below.

Axopora M. Edw. & Haime, H. N. Cor. III p. 243 by them placed amongst their Milleporidæ, next to Lyellia as occurring in the Eocene formation near Paris and London. It is said that the coenenchyma is reticulated and spongy and that the septa are rudimentary. In the detailed description of the two principal species again it is said, that there are no septa at all. Some years later Duncan in Supplem. to Brit. Foss. Corals described two species and these have absolutely no septa. Zittel (Palæozoologie I p. 288) has placed it amongst the genuine Milleporidæ and this seems to me to be its true affinity.

Battersbyia M. Edw. & Haime from the Devonian of England, which by these authors was classed as one of the Heliolitidæ, has through the researches of Duncan [1] been recognized to be one of the *Astræidæ*, the supposed coenenchyma being only a parasitic incrusting Stromatopora. Ferd. Roemer [2] again regards it as a Rugose Coral. At all events there is nothing to justify its being ranged with the Heliolitidæ.

Calapœcia Billings (derived from *καλός*, beautiful and *ἀποικία* colony, consequently not to be written as Calopœcia or Calapæcia as some authors do). Through examination

[1] Philos. Transact. vol. 157 p. 648.
[2] Leth. palæoz. p. 415.

of original specimens I am convinced that the genera Columnopora NICHOLSON, Houghtonia ROMINGER and probably also Lyopora NICHOLSON & ETHERIDGE are identical with this genus and consequently superfluous. ZITTEL and SARDESON have numerated it amongst the Heliolitidæ.[1] I do not think that it belongs there in spite of some superficial similarity. As it is provided with a perforated theca, with an unstable number of septa, twenty or more and less, and a quite different sort of coenenchyma, I cannot regard it as one of the Heliolitidæ according to my conception of this family. It reaches from the highest Lower Silurian to the lowest beds of the Upper Silurian and has a very wide geographical distribution from Canada and North America, England, Norway, Dalecarlia and Gotland in Sweden, Esthonia to the middle Tunguska river in Sibiria.

Columnopora, see Calapœcia.

Cyrtophyllum, LINDSTRÖM, Silurische Korallen aus Nord-Russland und Sibirien in Bihang till Svenska Vetensk. Akad. Handl. Bd 6, N:o 18 p. 17, fig. 1—2. SARDESON (Tabulaten page 276) has, inadvertently calling it Cyathophyllum, placed it with Plasmopora from which genus, as well as from all other Heliolitidæ it is widely different through its numerous, about forty septa, through its peculiar and characteristic tabulæ. I have placed it as nearest to Acervularia. The outlines of the polypierites are very clear and defined and there is seldom much coenenchyma between them.

Fistulipora. Concerning this, as well as other fossils, rather to be regarded as Bryozoa, I have given some details below in treating of the affinities of Heliol. decipiens.

Haimeophyllum BILLINGS. ZITTEL (Palæozoologie I, p. 213) enumerates this devonian genus amongst the Heliolitidæ. On examination of specimens, which BILLINGS himself once sent me, I can not find the least to justify its affinity with Heliopora or Heliolites. There is no coenenchyma, there are about forty septa and the thecæ are perforated by oscula, like those of the Favositidæ. The calicles are filled with a dissepiment, like that in the Cystiphyllidæ.

The name of this genus ought not to be retained any longer as it is quite identical with Chonostegites M. EDW. & H., founded by them in 1850. Their Chon. Clappi is indeed the same fossil as Haimeophyllum ordinatum BILLINGS (first described 1859), as I have learnt by comparing specimens of both. It is not likely that it is related to Michelinia as some American authors think.

Halysites. In a paper in Annals and Mag. Nat. Sciences 1876 I placed this genus amongst the Heliolitidæ on account of the similarity in structure as observed in longitudinal sections. Further there is an apparent homology with the coenenchyma through the intercalicinal tubes. But as the mode of growth of the Halysitæ is so peculiar, it may at present be left as a type for itself.

Heliopora, BLAINVILLE. No other coral has been so often and so eagerly compared with Heliolites as this and yet, I think, that a closer investigation will prove, that there is very little of a real affinity between them. Too much stress, as to their differing,

[1] I myself also in a paper on the Tabulata in Ann. mag. N. Hist. 1876 vol. II p. 16 ranged this genus with the Heliolitidæ along with Thecostegites, Halysites and with some doubt Thecia. But further researches have lead me to abandon this view.

may, however, not be laid on the total absence of all connecting links between these genera from the end of the middle Devonian to the Recent times.

Several fossil corals have been called Heliopora, which on closer inspection by no means can be considered as such. Milne Edwards and Haime referred to Heliopora two species from the Cretaceous strata of Gosau, which Reuss had described as belonging to his genus Polytremacis. They had better to be left there, as may be found by studying the beautiful figures of Reuss.[1] Whatever they may be, they are certainly no Helioporæ. The same is the case with Heliop. deformis Michelin, which fossildealers send under that name from the tertiaries of Auvers in France. Quenstedt[2] has described and figured a Heliopora bipartita from Berchtesgaden. From the figures to judge he has commingled two different species, none of them a Heliopora. In one (fig. 14) the two opposite septa of the first order, (because they must be genuine septa), have coalesced with a little columella in the centrum. The other form, Heliop. var. sparsipora (fig. 19), differs so completely that it must be assumed it belongs to another genus than the former. If there now is no evidence of fossil Heliopora we have to take the recent Hel. coerulea into consideration as the only species known.

Several authors, as Hinde, Neumayr, Wentzel etc., have already denied all alliance between Heliopora and Heliolites.

As Neumayr has well pointed out there are no true septa. The short, blunt spines, which surround the edge of the calicle, are nothing else but the same sort of echinulations which stand up on the coenenchyma between its open tubes and are only continuations from the core or nucleus, the string which forms the centre of the rods, that make up the whole of the corallum. This central string which evidently is the oldest part of the rod, as it grows in advance of the ambient tegument, is of a splendid cream colour, which by transmitted light looks black. It is enclosed by a mass of pale, blue-greenish calcite fibrillæ, growing out from it upwards in an acute angle. These rods meet from opposite sides around the calicles and the coenenchymal tubes and at the meeting-point they have a jagged outline. A feature in Heliopora, which decidedly removes it far from the Heliolitidæ is the total want of a calicular theca. The pseudosepta or rather the tubercles around its rim are not in any way connected with each other, nor do they grow out from any theca as in the Heliolitidæ.

There is no ground for the statement that the calicles of Heliopora as a rule are surrounded by twelve such pseudosepta, as in Heliolites. In one and twenty calicles I found the number of the pseudosepta to be as shown in the annexed table.

Number of calicles	2	2	2	4	3	5	1	2
Number of septa in each . .	10	11	12	13	14	15	16	17

As Bourne remarked before me fifteen seems to be the most prevalent number.

[1] Denkschriften der K. K. Akad. der Wissenschaft. vol. VII, pl. 24. — Zittel Palæozool. I, p. 212 also has given figures of »Heliopora» Polytremacis Partschi partly copied from Reuss and partly (f. 122 a) new, differing from the figures of the latter especially as to the coenenchyma. The longitudinal section clearly shows the difference from Heliopora.

[2] Petrefact. Deutschlands p. 154, pl. 149 fig. 14—19.

Every one of these pseudosepta is continued downwards by a narrow, not much prominent ridge, the interior wall of the calicle being consequently fluted, as it were, through quite as many grooves as there are ridges or pseudosepta round the aperture. The ridges are regularly provided with short knobs.

The tabulæ in the calicles, as well as in the coenenchymal tubes are by far not so numerous as one could think by the figures given by several authors. They are very thin, concave and situated at a great distance from each other and moreover often deficient in the most narrow coenenchymal tubes.[1]

Houghtonia, see Calapoecia.

Lyopora, see Calapoecia.

Millepora L. Much needs not to be said concerning this genus, since the discoveries of AGASSIZ and MOSELEY have shown that it is a Hydrozoon and their views have been accepted by all authors.

Polysolenia REUSS in »Reise der Novara. Geologischer Theil» 2r Bd, p. 172, Taf. 2, fig. 3. — This fossil coral, which ZITTEL regards as one of the Helioporidæ, and consequently according to his views as nearly related with Heliolites, was found in the tertiary formation of Java and by its founder compared with Polytremacis and Heliopora. The calicles have eight constant septa, seemingly in two cycles of four septa each, the coenenchyma consists of circular tubes with thick walls and are traversed by regular, horizontal, though scarse tabulæ. In the calicles, if I understand the section fig. 3*d* rightly, the tabulæ are more numerous and intersected by the septa. Thus far, as the figures show. In the descriptive letterpress, however, REUSS tells that there are no »Quersepta», and that the walls of the coenenchymal tubes are perforated through »Quercanäle» (traverse tubes). It seems, however, that he has mistaken the tabulæ for tubes and that he thinks the loculi between the septa to be the septa themselves. By what now has been stated, concerning its structure, sufficiently is shown that this genus by no means can be considered as related to the Heliolitidæ.

Polytremacis D'ORBIGNY. I cannot find that this author ever gave a clear definition of this genus. It seems that he considered Pol. Blainvilleana (Heliop. Blainvilleana MICHELIN Iconographie p. 27 fig. 6*a*—6*b* not fig. 8) as the type species as he mentions this first. MILNE EDWARDS & HAIME, who follow him, say that the septa in this genus are well developed and so large that they nearly meet in the centre of the calicles, but this is not the case in any of the species known, excepting that which REUSS, according to my view, wrongly called Pol. Blainvilleana and which if exactly figured can not possibly belong to this genus.[2] All the others have short septa and the surface is as in a Heliopora. That remarkable coral again has according to the figures of REUSS twelve regular, equalsized septa, stretching near to the centre surrounded by a tubular coenenchyma with horizontal tabulæ and the calicles have concave tabulæ, the whole thus giving a real Heliolitidean appearance. But when we turn to the printed description it is stated that

[1] BOURNE (Heliopora) remarks on the difference in the propagation of the coenenchymal tubes in Heliolites in opposition to that of Heliopora and Favosites. — Favosites can scarcely be brought in comparison with these as there is no coenenchyma.

[2] Wiener Denkschriften vol. 7 (1854) pl. 24 fig. 4—7.

the septa (»Radiarlamellen») are between 8—14. Evidently there are several quite different species and even genera commingled under the name of Pol. Blainvilleana. The other forms have short, numerous septa and the surface resembles that of Heliopora. MICHELIN's Hel. (Polytremacis D'ORB.) Blainvilleana can scarcely, if we may judge by his obscure figures, be identical with the homonym species of REUSS and they cannot be retained in the same genus. MICHELIN's species which is provided with a greater number of septa is probably identical with the Heliopora Blainvilleana of QUENSTEDT (Petref. Deutschl. p. 901, pl. 170 fig. 30) which this author also thinks is the same as REUSS' first species Polytr. Partschi. As I have not been able to examine their specimens, I must leave this for other authors to decide. It seems, however, doubtful whether Polytr. Partschi REUSS with its peculiar broad, collarlike circle of septa or pseudosepta and its starry coenenchyma can be identical with Polytr. Blainvilleana MICHELIN & QUENSTEDT. Polytr. macrostoma, the third species of REUSS may also be generically different from the others.

I have had some few specimens of two species kindly sent me from Dr LAUBE in Prag, one called P. Partschi REUSS,[1] the other P. Blainvilleana, none of them corresponding with the descriptions or figures of REUSS, though that which is denominated Pol. Blainvilleana comes near to Pol. Partschi of REUSS. Both have a great number of short pointed septa, amounting to between 30—40 in the larger calicles, and continuing outwards in connection with the coenenchyma. This is quite different in both: reticulate, open tubes, Heliolites-like in P. Partschi, spiny or warty in P. Blainvilleana. In a horizontal section of the latter small narrow tubes, somewhat arranged in lines or series lie imbedded in a thick mass, which in a longitudinal section is composed of rods, baculi, the former species has some scarce tabulæ in the narrow tubes. I have examined a specimen sent from the Geologische Reichs-Anstalt in Wien with the denomination Polytremacis Blainvilleana with the number of septa varying from eight to twenty; tabulæ in the calicles and the coenenchymal tubes; the coenenchyma on the surface with small points or also smooth.

To sum up, if a genus ever was in need of revision it is this, and untill this has been executed by somebody provided with sufficient material to accomplish the research, we may suspend our final opinion as to the systematic position of it and in the meanwhile keep it apart from the Heliolitidæ.

Stylophyllum REUSS is by ZITTEL enumerated as one of the Helioporidæ along with the Heliolitidæ. The description and figures of REUSS[2] show that it is a most abnormal coral, without any coenenchyma at all and with a great number of septal spines in irregular rows and vesicular tabulæ and that it consequently does not show any affinity with the Heliolitidæ.

[1] It may here be remarked that the figures of Heliopora Partschi, p. 212 ZITTEL Palæozoologie, belong to widely different species. Figure 122*b* is evidently a reproduction of fig. 7 pl. XXIV of REUSS' memoir in Wiener Denkschriften vol. 7 and by him intended to represent a longitudinal section of Polytrem. Blainvilleana. But this species, as stated above, more Heliolitidean than any, cannot be a Heliopora, nor a Polytremacis, and must form a new genus. A longitudinal section of Heliopora, as well as of Polytremacis is quite different. NEUMAYR in his »Stämme» pag. 305 has again reproduced the figure of ZITTEL and names it simply »Heliopora» and he describes it also as representing the living Heliopora, what is highly misleading. The fig. 122*a* should represent Heliop. (Polytremacis) Partschi, but the indistinctness of its execution allows no decisive opinion of what species it really is.

[2] Wiener Denkschriften, 1854 vol. 7 p. 132 pl. XXI fig. 1—3.

Tetradium, DANA. NICHOLSON[1] says that Tetradium presents a very striking resemblance to Heliolites in the form of the septa, which he considers as pseudosepta. On the same account many other corals, not so dubious as Tetradium, might also be classed as allies to Heliolites.

BOURNE[2] says that Tetradium minus resembles Heliolites in the »close approximation of its corallites, in the possession of tabulæ» and the pseudosepta. I cannot find that there is the least resemblance between these two genera in the position of the »corallites» (? = calicles), as in Heliolites the calicles are more or less distantiated through the intervening coenenchyma, in Tetradium, on the contary, the calicles are entirely contiguous without the least traces of any coenenchyma. The »possession of tabulæ» is a character which is shared by such a diversity of not else allied corals that it is of no value at all for pointing out any affinity between those two genera and the same is also the case with the septa. The regularity and the constancy of the twelve septa in Heliolites in contradistinction with the characteristic four septa in Tetradium must moreover exclude all ideas of any affinity between them.

Thecia, GOLDFUSS. As to the pretended affinity of this genus with Heliolites it may be enough to remind that the calicles have no interior theca and are confluent with each other, communicating through an abundant system of horizontal tubes lying in consecutive series above each other, in a longitudinal section giving the appearance as of oscula, like those in the walls of Favosites. The septa are irregular and of a varying number. The tabulæ are thin and scarce, sometimes arranged like those of Cystiphyllum, in a few instances regular. Consequently I cannot consider Thecia as a member of the Heliolitidæ.

Thecostegites, EDW. & H. Having lately through the kindness of M. D. OEHLERT been enabled so examine specimens of Thec. Bouchardi E. H., I have found that I formerly was mistaken in supposing its affinity with the Heliolitidæ (Ann. Mag. Nat. Hist. 1876, vol. II, p. 16). It has tabulæ as the Syringoporæ and a few tubelike connections between the calicles; the calicles are in many instances closed with a pseudooperculum as in several Favositæ and the connecting »plateaus» are not of the nature of a coenenchyma.

The now revised genera being, on reasons alleged, eliminated from the close affinity of the Heliolitidæ, this family consequently retains of the previously known genera only the following ones, viz.

Heliolites, DANA.

Plasmopora, MILNE EDW. & HAIME.

Propora, LONSD.

Diploëpora, QUENSTEDT.

Lyellia, M. E. & H. (if it really is an independent genus).

Further I have appended the family of the Coccoseridæ to the Heliolitidæ as nearly related on account of their regular and consimilar septal formation, their mode of

[1] Tabulate Corals p. 234.
[2] Heliopora p. 469.

gemmation, and also in some degree of their coenenchyma. They have indeed by some authors been mistaken for and described as true Heliolitidæ.

As to the affinities of these groups with other corals I cannot at present find any other palæozoic allies. In regard to the often pretended proximity of the Favositidæ and the Heliolitidæ I have tried to show further on, in the description of Heliol. decipiens that there exist fundamental dissimilarities between these two groups.

Distribution.

Geographical and geological.

The genera of this family have a world-wide distribution, as well as some of the species. In almost all countries where Silurian and Devonian strata have been searched for them, they have been found. Not to mention Europe and the United States of North America, they have been discovered in the farthest boreal parts of North America and Canada, in China, in Sibiria, in Niti in the Himalayan Mountains, in the Caucasian Alps and in Australia.

The space of time during which they existed, as far as at present known, extends between the uppermost beds of the Lower Silurian (none being found below the Bala beds of England or the Wesenberg strata of Estland), and the Lowest beds of the Upper Devonian formation, after which time all traces of them are lost and they have probably become extinct, and if, as I have stated above, the supposed allied corals in the cretaceous strata and the recent Heliopora do not link them together, there seems not much hope left to rely on the imperfection of the geological record for explaining their non presence. The Scalpella found in the Upper Silurian of Gotland having no direct relatives before the cretaceous times form a most striking instance of the validity of accepting such an imperfection. But it fails in regard to the Heliolitidæ. There is only according to Reuss' descriptions of the Gosau Corals a single species, his Polytremacis Blainvilleana, which in a most deceiving manner shows the characters of the Heliolitidæ. If this in reality is to be regarded as a survival of the Devonian Heliolitidæ or not, must at present be left undecided, as it seems to stand so isolated and as we must wait for more ample proofs.

As to the statement of Milne-Edwards and Haime (British Foss. Corals, Mountain limestone p. 152) of a Carboniferous Propora, some remarks are to be found in the end of the descriptions of that genus.

The Heliolitidæ are most numerous in the Upper Silurian strata and more so in the northern region of Siluria. In the Lower Silurian beds the Plasmoporinæ and the Coccoseridæ prevail, the Heliolitinæ proper thrived chiefly in the Upper Silurian times. The Coccoseridæ which are so nearly related to the Heliolitidæ are in the main confined to the Lower Silurian strata, and only a few remains have been discovered in the lowest Upper Silurians.

Some of the Lower Silurian Heliolitidæ have the distinguishing feature of a scarce coenenchyma and of closely placed calicles. This may perhaps, taken together with the development of the polypary of Heliolites, indicate a lost stage of early or ancestral forms of Heliolitidæ in which there was no coenenchyma at all developed and that this came in by and by.

The stratigraphical occurrence of the species is as follows, more detailed notes are given in the special descriptions.

Exclusively Lower Silurian.

Heliolites hirsutus n.
Proheliolites dubius Fr. Schmidt.
Propora bacillifera n.
Prop. cancellata n.
Coccoseris Ungerni Eichw.
» microporus Eichw.
» megastoma M'Coy.
» var. minor.
» micraster n.
Protaræa vetusta J. Hall.
Acantholithus lateseptatus n.

Common to Lower and Up. Silurian.

Heliolites interstinctus L.
Hel. parvistella F. Roem.
» var. intricatus.
Propora tubulata var. Lonsd.
» conferta E. H.
Acantholithus asteriscus F. Roemer.

Only Upper Silurian.

Heliolites Barrandei var. spongodes.
» fasciatus n.
» repletus n.
» Liljevalli n.
Cosmiolithus ornatus n.
» halysitoides n.
Plasmopora petaliformis Lonsd.
» foroensis n.
» calyculata n.
» var. tuberosa n.
» scita E. H.
» follis E. H.
» stella n.
» scala n.
» rosa n.
» suprema n.
» rudis n.
» heliolitoides n.
» reticulata n.
Propora tubulata Lonsd.
» conferta var. minima n.
» euryacantha n.
» speciosa Billings.
» compacta n.
» ambigua n.
Camptolithus papillatus Roming.
Diploëpora Grayi E. H.
Pycnolithus bifidus n.

Common to Upper Silurian and Devonian.

Hel. interstinctus L.
Hel. Barrandei Penecke.

Only Devonian.

Heliolites porosus Goldf.

In this memoir fourty-six species and varieties have been described, but of course this does not comprise all hitherto known of which several must be classed as synonyms to older. Nevertheless the following list of the distribution of the Heliolitidæ must of necessity be very incomplete in as far as it treats of other countries than the northern and no doubt a greater number is to be found in extra European countries, of which I have had no notion.

Sweden.

Scania.

Heliolites interstinctus-decipiens M'Coy.

Westergötland.

Propora conferta E. H.

Isle of Öland.

Heliolites hirsutus n.
Propora conferta E. H.
Propora bacillifera n.
Propora sp.
Coccoseris megastoma var. minor.

Östergötland (Borenshult).

Propora speciosa BILLINGS.

Isle of Gotland.

Heliolites interstinctus L.
» Barrandei PENECKE.
» var. spongodes n.
» parvistella FERD. ROEM.
var. intricata n.
» fasciatus n.
» repletus n.
» Liljevalli n.
Cosmiolithus ornatus n.
» halysitoides n.
Plasmopora petaliformis LONSD.
» foroensis n.
» calyculata n.
» var. tuberosa n.
» scita E. H.
» stella n.
» scala n.
» rosa n.
» suprema n.
» rudis n.
» heliolitoides n.
» ? reticulata n.
Propora tubulata LONSD.
» euryacantha n.
» conferta E. H.
» var. minima n.
» speciosa BILLINGS.
» ? ambigua n.
Diploëpora Grayi E. H.
Pycnolithus bifidus n.

Dalarne (Dalecarlia).

Proheliolites dubius F. SCHM.
Propora conferta E. H.
» bacillifera n.
Coccoseris micraster n.
Protaræa vetusta J. HALL.
Acantholithus asteriscus FERD. ROEMER.

Jemtland.

Heliolit. interstinctus L.

Norway.

Heliolites interstinctus L.
» parvistella FERD. ROEM.
Plasmopora stella n.
Propora bacillifera n.
Prop. conferta E. H.
Coccoseris Ungerni EICHW.

These species I have examined myself in original specimens and besides KIÆR in his »Faunistische Uebersicht des norwegischen Silurgesteins» enumerates the following species, some still undescribed and possibly identical with some of the above enumerated.

Plasmopora primigenium K.
» ramosa n.
Proheliolites dubius F. SCHM.
Plasmopora parvotabulata K.
Plasmoporella convexotabulata K.
» connexotabulata K.
Heliolites intricatus var. lamellosus LM.
Plasmopora stellata K.
» intercedens K.
» Andersoni NICH. & ETH.

England.

Heliolites interstinctus L.
porosus GOLDF.
» parvistella F. ROEM.
Plasmopora petaliformis LONSD.
» calyculata n.
scita E. H.
» stella n.
Propora tubulata LONSD.
speciosa BILL.
Diploëpora Grayi E. H.
Coccoseris megastoma M'COY p. p.

Estland (Esthonia).

Hel. interstinctus L.
» parvistella F. ROEM.
» hirsutus n.
Proheliolites dubius FR. SCHM.
Propora tubulata LONSD. var.
conferta E. H.
» cancellata n.
» bacillifera n.
Diploëpora Grayi E. H.
Coccoseris Ungerni EICHW.
» microporus EICHW.
Protaræa vetusta J. HALL.
? Acantholithus lateseptatus n.
» asteriscus F. ROEM.

Bohemia & Austria.

Hel. interstinctus L.
parvistella F. ROEM.
Barrandei PEN.
Propora tubulata LONSD.

Germany.

Hel. porosus GOLDF.

France.

Hel. porosus GOLDF.
» interstinctus L.

Italy (Alpi carniche).

Hel. porosus GOLDF.
» interstinctus L.

Belgium.

Hel. porosus GOLDF.

United States (N. Am.).

Heliolites interstinctus L.
» Barrandei PEN.
» parvistella F. ROEM.
Plasmopora scita E. H.
» follis E. H.
Camptolithus papillatus ROMING.
Protaræa vetusta J. HALL.

Canada.

Propora conferta (= affinis BILL.).
speciosa BILL.
Protaræa vetusta var. major.

Arctic regions N. Am.

»Heliolites porosa», »Hel. megastoma», both probably Hel. interstinctus.

North Russia.

Hel. interstinctus L.
Propora compacta n.

Caucasus.

Hel. porosus GOLDF.
» solidus & concentricus ROMANOWSKY probably synonyms to the former.

Siberia.

Hel. interstinctus L.
Propora conferta var.
» compacta n.

China.

Hel. interstinctus L.
Propora conferta var.

Himalaya (Niti).

SALTER, in Palæontology of Niti 1865, p. 51 has a Heliol. depauperata Pl. 5 f. 5 which is an imperfect fragment with some calicles, uncertain whether a Heliolites at all.

Australia (N. S. Wales).

Heliolites Daintreei ETH.
Heliolites plasmoporoides described by R. ETHERIDGE jr. I am not sure of their affinities as I have not seen them. De KONINCK in his »Recherches sur les fossiles paléozoïques de la N. Galles du Sud» enumerates the following species.
Heliolites porosa GOLDF.
Heliolites megastoma MAC COY.
Hel. Murchisoni E. H.
Propora tubulata E. H.
Plasmopora petaliformis LONSD., but there is no evidence that the identification is justified.

A systematic Synopsis of the species described.

Fam. Heliolitidæ.

The corals appertaining to this family as well as the nearly connected one, the Coccoseridæ, are chiefly distinguished by their twelve regular septa, by the individual polypierites composed of an interior area enclosed within an inner theca and of an exterior area without any separating wall for each polypierite and forming a differently shaped coenenchyma

Of systematic essays published in the latest years upon the Heliolitidæ may be mentioned first that of Sardeson in his memoir »Beziehungen der fossilen Tabulaten zu den Alcyonarien» p. 353. His Suborder Helioporidæ embraces the families Heliolitidæ, Plasmoporidæ and Halysitidæ. Of these the first corresponds with my Heliolitinæ if Polytremacis, Heliopora and Sarcophyton be excluded. With my Plasmoporinæ his Plasmoporidæ agree in so far as the genera Plasmopora and Propora are concerned. Lyellia, Pinacopora and Houghtonia are to be removed as they partly are synonyms with other genera and partly belong to other families. His third family has certain features resembling those of the Heliolitidæ but the homology is not ascertained.

The latest attempt towards a systematic arrangement of this group is by Prof. Frech in »Neues Jahrbuch für Mineralogie» etc. 1897 p. 214. We there have the order Heliolithoidea with the families Heliolitidæ, Plasmoporidæ and Fistuliporidæ.

I propose to subdivide the Heliolitidæ and the Coccoseridæ in the following manner.

Tribus I. **Heliolitinæ.**

Septa thin, coherent lamellæ, coenenchyma of polygonal tubes.

Genus 1. *Heliolites.* Dana.

Coenenchyma monomorph.

Species 1. interstinctus L.
- 1*a*. var. decipiens Mac Coy.
- 2. porosus Goldfuss.
- 3. Barrandei Penecke.
- 4. var. spongodes n.
- 5. parvistella Ferd. Roemer.
- 6. var. intricatus n.
- 7. hirsutus n.
- 8. fasciatus n.

Species 9. repletus n.
10. Liljevalli n.

Genus 2. *Cosmiolithus* n.

Coenenchyma dimorph, thick walls, narrow tubes.
Species 11. ornatus n.
12. halysitoides n.

Genus 3. *Proheliolites.* KIÆR.

Coenenchyma scarce, septal spines directed downwards.
Species 13. dubius FR. SCHMIDT.

Tribus II. **Plasmoporinæ.**

Coenenchyma vesicular, theca thick.

Genus 4. *Plasmopora.* E. H.

Calicle with an »aureola», coenenchyma in its structure intermediate between vesicular and tubular.
Species 14. petaliformis LONSDALE.
15. foroensis n.
16. calyculata n.
17. var. tuberosa n.
18. scita E. H.
19. follis E. H.
20. stella n.
21. scala n.
22. rosa n.
23. suprema n.
24. rudis n.
25. heliolitoides n.
26. ? reticulata n.

Genus 5. *Propora.* E. H.

Coenenchyma chiefly vesicular, no aureola.
Species 27. tubulata LONSD.
28. euryacantha n.
29. conferta E. H.
30. var. minima n.
31. cancellata n.
32. speciosa BILLINGS.
33. compacta n.
34. bacillifera n.
35. ? ambigua n.

Genus 6. *Camptolithus* n.

Instead of tabulæ the calicles are provided with a vesicular tissue like that of the coenenchyma.

Species 36. papillatus ROMINGER.

Genus 7. *Diploëpora.* QUENST.

Coenenchyma partly vesicular, partly bacular.

Species 37. Grayi E. H.

Tribus III. **Pycnolithinæ.**

Genus 8. *Pycnolithus* n.

Coenenchyma dense or compact, of granular texture.

Species 38. bifidus n.

Subfamily **Coccoseridæ.**

Septa short, thick, central area of the calicle filled with columnar baculi the pointed tops of which form papillæ on the bottom of the calicle. Coenenchyma bacular with no or narrow tubes, in which few tabulæ.

Genus 1. *Coccoseris.* EICHWALD.

The sclerenchyma entirely composed of baculi, no tabulæ.

Species 1. Ungerni EICHW.
2. microporus EICHW.
3. megastoma M'COY.
4. var. minor n.
5. micraster n.

Genus 2. *Protarœa.* E. H.

Thin, incrusting coral, sclerenchyma much resembling that of the preceding genus, though more incoherent as to the septa, and with a very scarce coenenchyma.

Species 6. vetusta J. HALL.

Genus 3. *Acantholithus* n.

Septa thin, but built upon the same plan as in Coccoseris, coenenchyma with a few tabulated tubes.

Species 7. lateseptatus n.
8. asteriscus FERD. ROEMER.

Descriptions of Genera and Species.

Tribus I. **Heliolitinæ.**

This tribe comprises those genera which as a rule have twelve septa in the calicular area, being coherent lamellæ, more or less spiny on their margin. Regular tabulæ in the calicular tubes as well as in the tubes of the coenenchyma, which latter have a polygonal shape. According to the structure of this coenenchyma joint with other differences, as closer indicated in the descriptions further down, three genera may be discerned.

1. *Heliolites*, DANA, with monomorphous coenenchyma or all its tubes equalsized and polygonal.

2. *Cosmiolithus* nov. gen. with dimorphous coenenchyma or tubes of two different kinds.

3. *Proheliolites*, KIÆR, with very scarce coenenchyma, septal spines, unlike all others in this family, bent downwards. Coenenchymal gemmation from single tubes.

Genus *Heliolites*, DANA.

Synonyms.

1745. Millepora p. p. L. Cor. balt. p. 30.
1767. Madrepora p. p. L. S. N. ed. XII p. 1276.
1826. Astræa p. p. GOLDFUSS. Petref. Germ. p. 64.
1833. Heliopora p. p. STEININGER. Mém. Soc. Géol. de France p. 346.
1839. Porites p. p. LONSDALE. Sil. Syst. p. 686.
1845. Explanaria GEINITZ. Grundriss d. Verstein. p. 568.
1846. Heliolites DANA. Zoophyta, Un. St. Expl. Exp. p. 541.
1849. Lonsdalia D'ORB.[1] Note sur les polyp. foss. p. 12.
1850. Fistulipora p. p. MAC COY. An. Mag. N. H. Ser. 2, vol. 6, p. 285.
1850. Palæopora p. p. MAC COY. Ibid. 285.
1850. Geoporites D'ORBIGNY.[1] Prodrome, p. 49.
1895. Stelliporella WENTZEL. Zur Kenntniss der Zoantharia tabulata p. 27.
1895. Pachycanalicula ID. Ibid. p. 27.

DANA is the real author of this genus, but the name had been used long before by GUETTARD. This author, however, in his »heliolithe» joined a great number of dissimilar and not at all congeneric forms. The conception which DANA gave of the genus is the only true one.

Of the name Heliolites, from which also that of the family has been formed, as from the longest known and the most typical of all its congeners, I cannot find any earlier notice before GUETTARD employed it in 1770 in his »Mémoires sur différentes parties des Sciences et Arts», vol. 2 p. 284, where he says that he has »adopté le mot d'heliolithe» for such stones which have »des rayons comme le soleil». He evidently therewith meant to say, that he had adopted an earlier name, the more so as he in

[1] According to MILNE EDWARDS & HAIME. D'ORBIGNY's descriptions are too insufficient to find what he intended.

another place says that it has been already employed as »Heliolithos variorum autorum», I have in vain made a search for these authors, but the name has indeed, written in this manner, a classical form and in accordance with such ancient mineralogical names as Tecolithos, Hexacontalithos etc., which occur in PLINIUS Hist. Nat. Lib. 36, Cap. 19. It seems, however, that GUETTARD by some inadvertence left the true track and in his Mémoires, vol. 2 p. 419 created the name »Heliolithes», »Heliolithe», for his new »Genre XV» and thus imitated the many names ending on — *ites*, as *hæmatites* and others, which invariably are of the masculine gender, while those ending on — *itis*, being altogether gems, are of the feminine gender. It would have been more convenient, if he had transscribed Heliolithos into Heliolithus, as PLINIUS also uses similarly composed names for minerals, as Chrysolithus for instance.

Now to change the old, often and universally employed word Heliolites[1] and to transform it to what it ought to have been, would cause too much confusion and might certainly be approved by only very few, if any authors. Consequently it is better to keep it as it is. Again, on the contrary, for the new genera which may be created within this family, it seems advisable to form their names according to the Plinian rules. Thus, for instance, Acantholithus.

The corals which belong to this genus generally have grown in diskshaped, flat or slightly hemisphærical polyparies, on the inferior or basal surface covered with a thin, finely wrinkled epitheca. In some which are globular or slightly branching, calicles are formed on all sides and consequently without any epitheca.

The calicle has regular septa which sometimes have been entirely reduced so as to give the interior side of the theca a completely smooth surface. When they meet in the centre they may form various sorts of network or even columellalike structures. A little, transverse columellar protuberance often occurs in the middle of the calicle of Hel. interstinctus. Commonly the septa in this genus are entire lamellæ and not only spinous projections from the theca, as in the Favositidæ or even in other Heliolitidæ. But in Hel. Barrandei the edges of these lamellæ are serrated by long, curved spines.

The coenenchyma is generally composed of regularly polygonal tubes, which multiply through fission of their area by transverse sclerenchymatous partitions, that have developed across the aperture of a tube, from one wall to the other and thus dividing a tube into two. Every tube is circumscribed by its own wall; hence the dividing ridge between two adjoining tubes is a double wall.

The intimate structure of their longitudinal walls is of the fibrous nature as described above (p. 15) in the same way as the septa and the theca of the calicle, which are coherent. There is some good evidence of a direct continuation or prolongation of the septa out in the coenenchyma as is so manifest amongst the Plasmoporinæ; but there is no sign of an aureola, though specimens of Hel. porosus may indicate some approximation to it, as shown by WEISSERMEL's figure 3.[2] The dissepiment of the calicles consists of regularly horizontal tabulæ; in some of the oldest specimens from the Arach-

[1] This name must be written without *h* in accordance with the other words ending in *ites*, as not derivate from *lithos*.

[2] Zeitschr. deutsch. geol. Gesellschaft 1898 p. 61.

nophyllum stratum (*a*) of Gotland they are concave. The dissepiment of the coenenchyma is also composed of regular, though much more densely crowded tabulæ.

The gemmation has been observed to be of two different kinds viz. 1. *Coenenchymal* and 2. *Intracalicinal*, both as described above at p. 19, 22. Some differences of a specific nature are mentioned below under the species.

Very small polyparies, affixed to other corals or shells, consisting of an initial polypierite and a few, three or four, which have sprouted from it, testify to the development out of ova. The young, of necessity free swimming larva or further developed young polyp had fixed itself and secreted the wormlike tube, the first beginning of the polypary as stated more in detail above.

The geological distribution of the species of this genus, which are described below, is seen from the next table.

	Lower Silurian.	Upper Silurian.							Devonian.		
	Uppermost beds.	Arachnophyllum.	Llandovery.	Wenlock shale.	Wenlock limestone.	Ludlow.			Lower.	Middle.	Upper.
		a	b	c	d	f	g	h			
Heliolites interstinctus L.	*	*	*	*	*	*	*	*	*		
var. decipiens Mac Coy		*	*	*	*	*	*	*	*		
Hel. porosus Goldfuss									*	*	
Hel. Barrandei Penecke		*			*	*	*	*	*	*	
var. spongodes n.			*	*							
Hel. parvistella Ferd. Roemer	*	*	*	*	*	*	*	*			
Hel. parvistella-intricatus				*							
Hel. fasciatus n.		*									
Hel. repletus n.			*	*							
Hel. Liljevalli n.		*									
Hel. hirsutus n.	*										

As here shown this genus at first appears, though scantily represented, in the uppermost beds of the Lower Silurian, from the Leptæna limestone of Dalecarlia in Sweden, and in the detached limestone blocks at Sadewitz in Silesia, which seem to be derived from the »Lyckholmer Schicht» of Estonia and also in these. It occurs in great richness of varieties and specimens in the Upper Silurian of Sweden, England, Russia, Bohemia, North-America, China and Australia and continues through the Lower Devonian to the lower division of the Upper Devonian, as mentioned above at p. 31, after which time it seems to have become extinct. It is found in the Devonian strata of Russia, Austria, Germany, Italy, France and England.

One species, Hel. Barrandei, is common to both the Upper Silurian and Devonian formations and the same is probably the case with Hel. interstinctus.

Heliolites interstinctus. L.

Plate I figs. 1—36, Pl. II f. 1—2. Pl. III f. 1—2.

Syn.

1745. Millepora subrotunda, poris minimis, confertis, majoribusque crenatis remotis, L. Corallia baltica, p. 30 N:o XIII, fig. XXIV.

1749. » » » » L. Amoen. Acad. I, 99.

1767. Madrepora interstincta, L. p. p. Syst. Nat. ed. XII, p. 1276.

1819. Madreporites interstinctus, WAHLENBERG. Petref. Svec., p. 98. A short description intended to embrace the Linnean form.

1828. Astræa stellulata, HIS. Anteckn. IV, p. 241.

1831. Astræa interstincta, ID. p. p. Anteckn. V, p. 127 and Esquisse, p. 26. The collections of HISINGER preserved in the State Museum of Natural Hist. at Stockholm contain under the varying names of Astræa porosa and Astræa interstincta a number of different Heliolitidæ.

1838. Astræa porosa, ANGELIN. Mus. Palæont. Svecicum, N:o 5.

1839. Porites pyriformis, LONSDALE. Sil. Syst., p. 686, pl. 16, fig. 2*c*, 2*d*, 2*e*. Figs. 2*a*, 2*b* belong scarcely to the same species, possibly it is a variety with small calicles.

1841. Astræa porosa, HISINGER. Förteckning, p. 58.

1845. Porites pyriformis, LONSD. in Murchison Russia, vol. I, p. 625.

1846. Porites interstincta, KEYSERLING. Beobacht. auf einer Reise in Petschora Land, p. 175.

1851. Palæopora interstincta, M'COY. Brit. Palæoz. Fossils, p. 15.

1851. Palæopora ? favosa, M'COY p. p. Ibid. p. 15. This species is evidently composed of incongruous elements and, amongst the figures on pl. IC, the fig. 3*b* entirely coincides with the Gotland specimens.

1851. Heliolites subrotundus, SALTER, in MURCHISON Silurian Rocks of Scotland, Qu. Journ. Geol. Soc. vol. 7, p. 171 and also p. 144, pl. IX, f. 9. It is possible that this may he identical with this species, but there is no description, and the figure of a cast leaves the identity undecided. It might as well be an impression of a Coccoseris. Salter adopted the species name »subrotundus» from the second word of the description in Cor. Balt., erroneously attributing it to FOUGT.

1852. Heliolites macrostylis, HALL. Pal. N. York II, p. 133, pl. 36*A*, fig. 2*a* is probably identical with this species, not Hel. pyriformis HALL.

1854 ? Heliolites interstincta, EDW. H. p. p. Brit. Foss. Cor. p. 249, pl. 57, fig. 5*b*. This fig. is the only one of all given that can be identified with ours. The descriptions given in the various works of these authors are not so consistent which each other that they can be regarded as aiming at the same species. In Polyp. palæoz. there is given as a character »douze cloisons assez bien développées», in Brit. Foss. Cor. again the figure cited above shows short equal sized septa.

1854. Heliolites interstinctus, SALTER in Siluria, 1:st ed. p. 120, f. 3, 4, 5, pl. 39, f. 2—2*e*. Fig. 3 called Hel. megastoma. The same figs. recur in the later editions of Siluria.

1856—57. Heliolites porosa, HAUGHTON. Geol. Notes & Illustrations, Appendix to M'CLINTOCK, Reminiscenses of Antarctic Ice Travel in Journ. R. Dublin Soc. vol. I, p. 183, pl. X, fig. 5, 5*a*, bad figures and incomplete description. Worn specimen, but probably of this species.

1862. Porites megastoma, M'COY. Sil. foss. of Ireland p. 62, pl. IV, f. 19. The MS of this work was finished already in 1846, but was not printed before 1862. In British Pal. Foss. p. 16, the first part of which was printed 1851, he refers to this work, when describing a different coral, being a Coccoseris, with the same denomination.

1876. Heliolites megastoma, ROMINGER. Geol. Survey of Michigan, vol. III, pt. II, p. 11, pl. 1, f. 3. I have received specimens from the late Dr ROMINGER, found at Point Detour, Michigan, which quite correspond with the variety from the highest Gotland strata with large calicles.

1878. Heliolites megastomus (!) R. ETHERIDGE S:r. Palæontology of the coasts of the Arctic Lands etc. Qu. Journ. Geol. Soc. vol. 34, p. 581. Belongs possibly to this species, but the description is too short.

1878. Heliol. interstincta, QUENSTEDT. Petref.-Kunde Deutschlands 1e Abtheil. 6r Bd, p. 142, pl. 148, fig. 25.

1879. Hel. megastoma, NICHOLSON. Tabulate Corals p. 244, pl. XII, f. 2, 2*a*.

1880. Hel. interstincta, NICHOLSON & ETHERIDGE p. p. Sil. Foss. Girvan p. 254, pl. XVI, fig. 4 cet. exclusis.

1882. Heliolites interstinctus, LDM. Sil. Korall. aus N. Russland und Sibirien, p. 19.

1883. » » ID. Obersilur. Kor. von Tshau-Tiën in RICHTHOFEN China Bd IV, p. 54, pl. V, f. 7.

1883. » » FERD. ROEMER p. p. Lethæa geogn. p. 506. Several species seem to have been classed together. The figures in the Atlas, published 1876, also represent dissimilar forms.

1883. » » J. COLLET. 12th Ann. Rept. Indiana, p. 252, pl. 2, figs. 1, 2, 3.

1885. » » DAVIS. Kentucky Foss. Corals, Pt. II, pl. 1, fig. 3. It is uncertain whether fig. 4 also belongs to this species as stated by the author.

1888. » » LDM. Upper Sil. Foss. of Sweden, p. 21.

1889. » » TOLL. Die palæozoischen Versteinerungen der Insel Kotelnoy. Mém. Ac. Sc. de Russie T. 37, p. 47.

1889. » » LESLEY. Pennsylv. Geol. Rept. pt. 4, Dictionary Foss. Penn. p. 273, figs. 1—3.

1895. » » LDM. On the Corallia baltica of Linnæus. Öfvers. Vet. Akad. Förhandl. p. 636.

1895. » » WENTZEL. Zoantharia tabulata. Denkschr. Wiener Akad. d. Wissensch. p. 506 (30 in Separ.) pl. 1, f. 1—7.

There cannot exist the least doubt that LINNÆUS did not intend to enclose all Gotland Heliolitæ under this one. But to judge from the type specimen drawn and described in his »Corallia Baltica» it was this he had in view as the type. The reference of LINNÆUS to BROMELL (Lithogr. Suecana) identifying the »Porus tuberiformis» of the latter with Millepora interstincta is not corroborated by the obscure description and figure of BROMELL. NICHOLSON and ETHERIDGE who have ranged a number of disparate Heliolitæ under the denomination of Hel. interstinctus, say[1] concerning the original type of LINNÆUS: »On this point we have nothing to guide us but the statement of MILNE EDWARDS and HAIME (Pol. Foss. Terr. Pal. p. 214) that the septa in Hel. interstincta are »assez bien développées». But it may be remarked, that the last mentioned authors express their own opinion and that they do not say anything at all about LINNÆUS' type. Consequently it is difficult to find how their words could guide us to find what LINNÆUS had himself meant. For further particulars I may refer to my paper on LINNÆUS' »Corallia baltica» and also on the Corals in RICHTHOFEN's China vol. 4, where I have tried to prove that the species described by LINNÆUS is just this Hel. interstinctus.

Perhaps no other species of the genus Heliolites has been so often mistaken for others as this. So for instance FERD. ROEMER in his Silur. Verstein. von Tennessee p. 23 pl. II f. 5, 5*a* described a diskshaped fossil with rather small calicular openings without septa as Hel. interstinctus, in his »Sadewitz» again p. 24 pl. IV f. 4 a still more narrow-

[1] Fossils of Girvan p. 258.

tubed Heliolites with crenulated calicinal margin and twelve well developed septa reaching nearly to the centre has the same name. In his Lethæa geognostica, last edition, pl. 9 fig. 3*a*, he has copied the figure of Hel. interstinctus of M. Edw. and at last in the »Lethæa erratica», pl. v fig. 7, there is a new form without septa and nearly related to the first mentioned. Not one of these, which represent at least three different species, can be regarded as identical with Linnæus' type and must be removed from the list of the synonyms of Hel. interstinctus. We must not be led astray by the circumstance that Linnæus in subsequent editions introduced foreign and recent corals under the same specific name. There exists indeed none besides the fossil Gotland form, which is to be described below, to which the words »poris majoribus crenatis» and »marginibus aliquantum crenato, crenis circiter duodecim» can be applied.

In »Obersilurische Fauna des Timan» Herr N. Lebedeff[1] has at p. 13 described a coral, which he calls Hel. interstincta. But the description is so incomplete that the identity must be doubted. Lebedeff's figures[2] on pl. i fig. 3 do not show the real characters.

Hel. interstincta Weissermel 1894 Korallen .... Preussens, p. 666 cannot be a true interstinctus as he tells about »Zwölf wohl entwickelte Septen».

As very doubtful forms of this species I regard the following.

Porpital Madreporite, Parkinson. Org. remains II, p. 69, tab. vii f. 2, 4, 5.

Sarcinula punctata, Fleming. Hist. of Brit. Animals p. 508.

Porites favus Barrande MS from Tachlowitz.

Hel. subtubulata, M'Coy. Palæoz. Foss. p. 16 pl. iC f. 2.

Geoporites intermedia, D'Orbigny. Prodr. I, p. 49, according to M. Edw. & H. identical with this species, but as D'Orbigny does not give any characteristics, I cannot find if he is right.

Geoporites americana, D'Orb. Prodrome p. 108 much uncertain = Hel. parvistella F. Roemer ?.

Hel. megastoma, Eichwald. Lethæa rossica I,1 p. 453.

Hel. interstincta, Nicholson & Etheridge. Girvan p. 57.

A so common and so widely spread coral as Hel. interstinctus must already *a priori* be expected to offer a great number of variations and mutations. And so it in reality turns out to be. But in all this variability there is something in common and this will serve to establish the specific description.

The form of the polypary. As a rule the polypary has grown in flat or slightly vaulted disks, in undulating placentoid pieces, plane or a little excavate below. A local variety from the stratum *d* along the shore of Wisby, there very common, forms compressed, broad branches bearing calicles on all sides. From the edges and the surface there project finger- or hornlike prolongations, which when detached or broken might be mistaken for independant polyparies. There are also irregularly globular or pyriform polyparies, but by far not so common as the others.

[1] Mémoires du Comité géologique (de Russie) vol. xii, N:o 2. 1892.

[2] There is in the explanation of the figures a confusion of the numbers, giving f. 3 for Propora tubulata and f. 4 for Hel. interstinctus instead of *vice versa*.

Epitheca. In the disciform polyparies there is an extremely thin, in a section scarcely perceptible film, transversaly wrinkled and longitudinally finely striated. In the branching and globular polyparies there is of course not much of an epitheca. It there never forms a coherent covering on the surface, it occurs only in narrow irregular stripes forming zones, as it were, between the calicles. It must be the common, coenenchymal tissue which has secreted this fragmentary epitheca, probably at intervals when the living surface of the coral had retired within narrower boundaries and the surface outside it was dead. It must be borne in mind that this epitheca is the common exterior wall of all polypierites, corresponding to the simple wall which envelops the first or initial and single polypierite, from which the other have budded. It is an amplification from this secreted by a multiplicity of individuals placed along the borders of the polypary.

The calicle. The range of variability in regard to the size and the proximity of the calicles is very wide. The diameter ranges from 3 mms to 1 mm. or a little less. In length one and the same calicular tube has been found to reach a length of 15 mms and probably was still 10 mms longer as it was hidden in its lowest part. Those found in the youngest strata, the limestone beds signed as *f—g—h*, have in the rule the largest calicles, closely set and consequently a scanty coenenchyma. They are very shallow, generally only 0,5 mm. deep and consequently the living animal tissue cannot have been of any considerable thickness.

Septa. The circular margin of the area is often slightly exsert and, what is most characteristic, wrinkled with twelve short ingoing angles, in fact the twelve septa which continue downwards into the calicular tube as faintly prominent, straight ridges, so that the interior side assumes a fluted appearance. In some more perfect specimens the septa form extremely thin and short lamellæ with entire margin. In others again they are nearly evanescent so as to approach to the variety called Hel. decipiens, which actually, as will be shown further on, is nothing but a peculiar manner of growth of H. interstinctus. As PENECKE observed in his H. Barrandei that the septa have disappeared in deeper situated portions of the polypary may also be seen in Hel. interstinctus, as for instance in the peculiar specimen drawn Pl. I fig. 20 of which fig. 24, a section deeper down, exhibits quite empty calicles. This change is no doubt usually due to the fossilisation, but it may there also sometimes have been an original defect of septa. In some specimens as in one from the lowest beds there are in the youngest areas longer septa which later are shortened.

Columella. The centre of the calicles is almost without exception provided with a columellar protuberance of a variable shape, styliform, lamellar, straight or bent so as to form an angular lamella. (See pl. I figs. 9, 11, 12, 13, 14, 15, 20.) It may he branching (f. 14, 20) and occupy a larger space. As to its origin the figures 11 and 13 may give some explanation. In the specimen, fig. 11, which evidently is a calicle not quite mature, the septa on the right are longer than those at left, which are of the ordinary size. One of the lefthand septa reaches to the centre and as a continuation of it and in connexion with it lies the columella, also united with two other septa. In fig. 13 an earlier stage of development is represented. There are twelve septa of which a couple, lowest down, still show the vestiges of their origin out of the coenenchyma. They are else all large

and reach to the centre where they are united with some rests of as yet unchanged coenenchyma out of which later the columella develops. This central part remained isolated as columella, when the septa are shortened to their normal size. The top of the columella, in the large variety of figure 20, as represented in section fig. 22, is divided into tiny spines, else generally smooth. As is evident by many longitudinal sections, figs. 8, 15, 23, the columella has not been formed continually during the whole life of the polyp, its growth has been interrupted and continued anew (figs. 2, 8). It can be followed as a long whitish line in the centre of the calicular tube (fig. 15) and then again ceases. In fig. 2 it has a peculiar appearance, disconnected on two of the lowest tabulæ and again reappearing on one of the uppermost.

Tabulæ. They are in the rule horizontal, four on a length of one millim. They occur densely crowded near the top of the calicular tube (figs. 22—23) as to form large horizontal bands. This must depend on some abnormity, on an excessive or sickly secretion, an accelerated growth. Near the theca the tabulæ are sometimes wavy or provided with a sort of grooves, especially where they meet the septa (fig. 29). These remind a little of those which are seen in several species of Favosites and may have the same sort of origin as these but do not occur regularly.

Coenenchyma. The tubes of the coenenchyma are in the rule polygonal, five or six-sided, the dividing walls thick, as in specimen fig. 9, or threadfine as in fig. 20. The line which divides the walls of two contiguous tubes, can be discerned in specimens as fig. 9 and 13. There are closely set, regularly horizontal tabulæ, five on a length of one millim. or even more. The tubes augment by fission. A small partition wall grows out from the wall into the tube (many instances fig. 20), meets a similar from the opposite side (f. 13) or even four meet (f. 9) and form like a Tetradium four new tubes. In the coenenchyma between the second and third calicular tube at left in fig. 31 there is at first a single coenenchymal tube, which divides into two, and these again at a short distance again in two, so that four new have been produced out of one.

At times there has been a singular invasion of the coenenchyma over the calicles. It is as if an exuberant growth had forced it to cover these areas partially or completely and thus to extinguish or alter the life-organs there existing. Instances of this phenomenon are delineated in figs. 20, partial destruction, and in fig. 21, complete destruction of two calicles, in one of which the columella is still visible.

Propagation. 1. Through ova. That this has taken place is evident through the many small incipient polyparies consisting of a few polypierites, which have sprung out from a single primary one. (See figs. 25—27). This must of necessity have originated out of an ovum, passed through a larva stage and then fixed itself, secreting an epithecal envelope around itself. It has the form of a cornet, rapidly increasing in breadth, the theca is blackish, glossy and transversally finely striated. In a section, about one millim. above the initial tip (f. 30) only three small septa have been developed, and these are situated on that side of the polypary on which this lies fixed to the shells (fig. 26—27). And there is in the beginning no sign of any coenenchyma. This develops on the bottom side, the upper side left without any (fig. 25—27) and out of this new calicular

areas arise, as it seems in a quincunxial arrangement $\begin{smallmatrix} 3 & 3 & 3 \\ & 2\,2 & \\ & 1 & \end{smallmatrix}$ (see figs. 25, 27), which, however, soon is disturbed through the enlargement of the polypary with a great number of new calicles. Tabulæ have been secreted at an early period, almost immediately after the wall (fig. 28), thus appearing before the septa.

Gemmation. This is of three different sorts: 1. *Coenenchymal*, 2. *Intracalicinal*, 3. *Epithecal.*

1. *Coenenchymal* (pl. I figs. 32, I—IV and fig. 33). The series of sections, representing this change, has been obtained by scraping down with a knife the little calicle and cautiously observing every change. It embraces only a depth of one millim. ere unaltered coenenchyma was reached. Beginning from below (fig. 32, I) some nine coenenchymal tubes are seen to have assumed a deeper colour than the surrounding tubes and a reduction has set in at the lowest right corner. Next, as seen in the bottom of section II, which actually includes two stages, the walls of several tubes have been reduced or absorbed at the right hand while they are still complete on the upper side at left. In sect. II proper all tubes have vanished and an open area is created. Then the new septa begin to grow out irregularly, of unequal size, being already twelve in section III. In the last stage figured, sect. IV, they have grown still longer, tending towards the centre of the calicle. The completion of this, other specimens taken in consideration, seems to be, that the new formed septa attain the centrum, that a columella is formed by their union, that a new reduction in size sets in and the normal structure of the species is attained. In a longitudinal section representing the coenenchymal gemmation (pl. I f. 33) we also see how the coenenchyma gradually is dissolved, how the tabulæ are deranged, how soon a large calicular tabula is formed still interrupted by some irregular, remaining tubular walls, till at last the calicular tube is ready formed with its regular tabulæ.

2. *The intracalicinal gemmation* (pl. I figs. 34, I—IV and 35). The notion of its various phases has been obtained in the same way as in the previous case. A regular calicle, at the same level as the surrounding coenenchyma (sect. I) half and half of interstinctus and decipiens type, as so often occurs, with eight short septa on one side, and none on the other begins to raise its margin (sect. II), which thus becomes osculating and rises more and more above the coenenchyma so as to assume the shape of a little erect tube. In this stage there has been formed all around the septa, which now are distinctly twelve, between them and the theca a zone of coenenchymal tubes. This new theca, which of course did not exist before the calicle began to grow upwards, has originated at the same time the rising took place, and in sect. II we find its presence by the two small tubuli of incipient coenenchyma at the lowest, left corner. In the third stage III the coenenchymal ring has widened and been finished all round with its own strong and well marked theca. There are now two thecæ, an *interior* one from which the septa start, being the primitive calicular theca from which the septa emanate and an *exterior* one, enclosing both coenenchyma and calicle. The calicle and the septa have changed their aspect during this procedure, the septa are twelve, but irregular, broad, ingoing folds. The newformed coenenchyma is evidently an outgrowth from the interior theca, because the walls which divide its tubuli, regularly proceed from the angles between the septa towards the exterior theca.

The last stage of this instance, the tube which grew on the surface of a polypary (sect. IV) bears clearly the signs of degeneration, the coenenchyma so promising in the previous stage is nearly gone, the theca and the septa are, as it were, shrivelled up. This bud thus never attained to the perfection which is seen in many other small colonies which have grown up on the surface of larger polyparies. An instance of this on a small scale is given by the little colony in figure 35, where a similar tubular polypierite with irregular coenenchymal tubuli has procreated a smaller calicle.

3. *Epithecal gemmation.* Though of an excessive thinness the epitheca must possess strong vital functions where at its formation it is covered by a diminutive lining of living organic matter spred out from a polyp. I think that in no other way, than as originating directly out of the epitheca, can be interpreted such a section as that shown in figure 12. There it seems to have been a little coenenchymal basis from which the regular calicinal tube arose.

Geological and Geographical Distribution.

This species already appears in the Lower Silurian Strata of Russia. A specimen, belonging to the Museum of Reval, by Dr KLÆR signed as Hel. parvistella ROEMER, has been found in the Lyckholmer Schicht of the Island of Worms and it is a variety with small calicles. The same Museum also contains a specimen with uncommonly small calicles only 0,8 mm. in diameter from Hohenholm, Isle of Dagö. From the Upper Sil. of Norway in Malmö near Christiania the State Museum preserves specimens. In the Upper Silurian of the Asiatic Russia at the Lower Tunguska and Olenek it has been found by Russian explorers.[1] RICHTHOFEN found it in China at Tsiën-shui.[2] It was found in North Russia at Petschora.[3] I have specimens from the U. Silurian of Bohemia (étage e^2) at Kotzel, from Dudley in England, from North America, Niagara formation, and sent from Prof. JAMES HALL as Hel. megastoma, from Drummond Isl., Michigan. It also passes up in the Devonian formation, in the Middle Devonian of the Alpi carniche of Italy and also according to MILNE EDWARDS and HAIME in France at Néhou.

In Sweden it occurs only in the Upper Silurian and in the Island of Gotland it is one of the most common corals. The »Riks Museum» of Sweden is in possession of specimens from the following localities.

a. From the oldest stratum of Gotland, the Arachopophyllum stratum in detached pieces, broken up from the beds, which lie below the following strata.

bc. From the next shale beds, the shores north and south of Wisby to Halls huk and to Gnisvärd, Westergarn, Djupvik in Eksta, Lerberget in Stora Carlsö, Hablingbo, Östergarn, Lau (lower beds), Djupdya in När, Dember in Fårö, Kyrkbacken Fårö.

In the stratum *d* at Bunge Fårösund, Lansa Fårö, Ryssnäs Fårö, Kyrkbacken Fårö, Tjelders Boge, the shore of Boge, Kulshage kanal Hangvar, the hills at Kålensqvarn, Wisby and almost everywhere north and south of the town in the peculiar variety mentioned above on p. 43, at Lau, Enviken in Hamra and at the hill of Hoburg.

[1] LINDSTRÖM, Sil. Korallen aus N. Russland und Sibirien p. 9.
[2] RICHTHOFEN, China vol. 4, p. 54.
[3] KEYSERLING, Wissensch. Beobacht. p. 175.

In the uppermost strata, signed *f*, *g*, *h*, from Mannagårda in Lye, Lill Rone in Lye, Sandarfve kulle *f*—*h*, Lindeklint, Mallgårdsklint, Klinteberg, Lummelunds kanal, Follingbo, Hörsne, Bara hill, Simunde in Bara, Gothems hammar, the limestone between Bäl and Slite, Tjelders in Boge, the hills of Slite, Enholmen, Klints and Samsugn in Othem, Bunge and Fårösund.

In the other silurian strata of Sweden it has been found only in the province of Jemtland in the coralline limestone of Norderön.

Some remarks on Heliolites decipiens. Mac Coy.

Pl. II figs. 3—22.

I cannot have the least doubt that Mac Coy's Fistulipora decipiens[1] is identic with a greath number of Gotland specimens, which I have temporarily named Heliolites decipiens or Hel. interstinctus-decipiens, the more so, since through the kindness of Professor Th. Mac Kenny Hughes I have received a cast of Mac Coy's original specimen, preserved in the Woodwardian Museum at Cambridge. It has been partially figured plate II figs. 21, 22, and may be compared with the Gotland specimens figured on the same plate. Mac Coy himself says about his specimen: »So exactly does this resemble the Palæopora interstincta that I have little doubt it has often been confounded with it... I have seen this coral also in large masses in the Upper Silurian limestone of Gothland. Chief character wabes smooth within, perfectly destitute of lamellæ». Also Milne Edwards & Haime, who had examined M'Coy's specimen, say[2] that it much resembles a Heliolites and »the coenenchyma does not present the vesicular tissue, which is characteristic of the genus Fistulipora». Neither these authors nor anybody else seem ever to have reexamined the original or typical specimens of M'Coy's first described[3] species of Fistulipora, which occur in the Carboniferous formation of England and which ought to have been a leading norm for introducing new species into that genus. These type species, to judge by the descriptions and figures, widely differ from the same author's Fistulipora decipiens. Subsequent authors continued to join with these the most heterogenous forms. Assuming a certain similarity with Fist. decipiens, Billings in 1857 described a new species, named Fistulipora canadensis.[4] But already in 1862 Rominger[5] had found its real nature as being a true Favosites, which he in his last work[6] called Fav. canadensis and still later Nicholson[7] has confirmed this conclusion. I have been able to examine several specimens

[1] Ann. & Mag. Nat. Hist. 2d Series vol. 6, 1850, p. 285.

[2] Brit. Foss. Corals p. 298.

[3] Ann. Mag. Nat. Hist. 2d Ser. vol. III, p. 130. 1849.

[4] Geol. Survey of Canada, Report 1857 p. 165, and Canadian Naturalist and Geologist vol. III p. 420, also »Fossil Corals of Canada West» in Canadian Journal 1859, p. 98 fig. 1.

[5] On Calamoporæ in gravel deposits near Ann Arbor. Sillim. Journal 2d Ser. vol. 34, p. 397 as Calamopora canadensis.

[6] Geol. Survey of Michigan, vol. III, part II, p. 30, pl. VIII fig. 4.

[7] Structure and Affinities of the Genus Monticulipora 1881, p. 94.

of this coral, which were sent to me from Mr Billings, as well as from Rominger together with others and I can with certainty affirm the results both of Rominger and Nicholson.[1] My specimens of which I have given a couple of figures on plate II, figs. 23—26 distinctly present the tabulæ and the oscula of the thecæ which, however, are only visible in such calicles that have not been completely silicified. On the other hand I never, even in the best preserved specimens, have been able to see »the cycle of twelve rows of horizontal squamæ» of which Rominger speaks and I cannot understand what he means. Moreover he talks about »the radiated structure of the tubes». In the first description (l. c.) he writes about »twelve distinct longitudinal ridges» in the larger tubes and also of longitudinal striæ in the smaller tubes. Even if there are such, this does not militate against the Favosite-nature. There is, moreover, nothing that could be interpreted as coenenchyma. There are larger and smaller calicles, quite as in other palæozoic, especially Silurian Favositidæ. I have, on plate II fig. 28, given a figure of a Gotland Favosites, where the surface has an appearance nearly alike that of Fav. canadensis.

There are amongst the species of the genus Favosites two distinct groups, one with angular, polygonal calicles, all of nearly equal size, the other with one set of large calicles with circular aperture, surrounded by a great number of smaller, both polygonal and circular calicles of unequal size, intervening as a sort of quasi-coenenchyma between the large calicles. There are several transitions from such corals, where the larger, circular calicles not are so prominent, to others where they are placed at regular intervals from each other. Instances of this may be seen on the plates of Davis' Corals of Kentucky. Even in Favos. canadensis this irregularity may be remarked and it may be regarded as an extreme development of the tendency seen in some Favositidæ to have two sets of calicles. In these there exists no coenenchyma, there is not the least homology with the Heliolitidæ and there is no reason with Neumayr to say that »offenbar in naher Beziehung zu den Fistuliporen steht die im Silur und Devon verbreitete Familie der Heliolithiden».[2] This is quite in conformity with the views of Dana as expressed in Synopsis of the Report on Zoophytes 1859 p. 104 where the Heliolitidæ are enumerated in the subfamily of the Helioporinæ and Family of Favositidæ. In spite of the clear evidence given by Rominger and Nicholson Neumayr persisted in the view of the relation of F. canadensis with Heliolites and went so far as to say: »Wir haben in Fistulipora canadensis ein klares Bindeglied zwischen Favositiden und Heliolithiden vor uns». Wentzel already in 1895 criticized this view in his Memoir on the Tabulata (p. 23). Through some notion of Neumayr's views probably an unpublished Museum name, Heliolitina canadensis, occurs in American collections as a synonym to Favosites canadensis. The high authority which Neumayr still after his decease deservedly enjoys amongst many of his followers for his researches on the fossils of the mesozoic strata might contribute to perpetuate this evident error and I shall in the following table try to give an idea of the fundamental differences between the two groups named.

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[1] Nicholson in »Tabulate Corals», p. 289, when speaking of Fistulipora canadensis represents me as having in my paper of 1876 stated that it belongs to the Bryozoa, but I do not there mention it at all.

[2] Neumayr, Stämme des Thierreichs, p. 320.

Heliolitidæ.	Favositidæ.
1. Coenenchyma.	1. *No* coenenchyma.
2. Twelve regular, coherent septal lamellæ.	2. No coherent septal lamellæ, only septal spines of irregular number, 20 or 30, never regularly twelve.
3. Imperforate theca.	3. Perforate theca with numerous oscula.
4. Coenenchymal and *intra*calycinal gemmation.	4. *Inter*calycinal gemmation.
5. Tabulæ without fossulæ.	5. Tabulæ with fossulæ.
6. No epithecal coverings over the calicles, nor false opercula.	6. Epithecal coverings and false opercula.
7. Calicle preserving the same size during its lifetime.	7. Calicles increasing in size during continued growth.
8. Theca having a microscopic structure of fibrillæ directed obliquely upwards.	8. Thecæ of minute threadlike vertical elements.

After a long and continued examination of numerous specimens I have come to the conclusion that the fossil corals, which I of late have named Heliolites decipiens are nothing else but a phase or modification of the growth of Hel. interstinctus. A colony of this may for a time grow quite regularly, showing the twelve septa as described above, and then assume the appearance of decipiens. But there are also specimens where both sorts of calicles may be found alongside on the same surface. In one specimen, where the decipiens character predominates, there are, as figured pl. II figs. 3—6*a*, few calicles of which one, probably the youngest, has large unequally developped septa, irregularly curved, another fig. 4 where they are quite regular and equal, reaching far inwards, then there is one, fig. 5, with septa in the regular interstinctus-fashion, and at last fig. 6 we have the decipiens stage without the least traces of any septa.

Having thus duly considered the value of the innumerable gradations in conformation merging into each other, I cannot avoid the conclusion that Heliolites decipiens must be united with H. interstinctus as a variety, or perhaps rather more properly be regarded as a transient state in the growth, changing again into the typical shape. But this modification can also be stable a long while or during the whole existence of the colony and thus gain a certain appearance of independant specific value. It is questionable whether not other species than Hel. interstinctus may have had a »decipiens» stage, depending on the reduction of the septa. So I have found from the Middle Devonian of Eifel a large polyparium with calicles, in which no septa are visible. This might possibly be a transformation of Heliolites porosus. Pl. II fig. 20.

It must also be taken in consideration that a false appearance of a decipiens-stage can originate in the interior of all species through metamorphic changes in the fossilised structures, of which PENECKE has given good information.[1] Close beside quite intact

[1] Ueber die Fauna .... einiger paläozoischen Korallriffe der Ostalpen, Zeitschr. deutsch. geol. Gesellsch. 1887 p. 267, Taf. XX f. 3.

septal areas lie others with partly destroyed or as it were dissolved septa and again further on calicles without any septa at all, that is to say, as decipiens. Such changes make the determination and distinction very difficult or almost impossible and necessitate a series of transverse sections for comparison.

There may have been very slight exterior impulses to modify or alter and give a multiplicity of deviating characters to some polyparies which fundamentally or by descent are of the same stock.

A list of synonyms now follows enumerating the various forms which I consider as identical with Heliolites interstinctus-decipiens, thus completing the list of synonyms given above as pertaining solely to the typical form.

1837. Astræa porosa, HISINGER. Lethæa Suecica p. 98, pl. XXVIII, fig. 2.
1850. Fistulipora decipiens, MAC COY. Ann. Mag. Nat. Hist., 2d Ser., vol. VI, p. 285.
1851. » » ID. Palæozoic Fossils p. 11, pl. IC, fig. 1, 1*a*, 1*b*.
1854. Heliolites Murchisoni, M. EDW. & H. p. p. Brit. Foss. Cor., p. 250, pl. 57, fig. 6*a*, 6*b*. Only the figures cited, not the description, indicate the identity.
1854. Heliolites megastoma, M. EDW. & H. p. p. Brit. Foss. Cor., p. 251, pl. 58, figs. 2, 2*a*, 2*b*. The figs. 2*c*, 2*d* belong to a Lower Silurian species of Coccoseris, of which see below. There are no septa in the calicles, only in those of the Coccoseris figures, which may have caused the authors to speak of »twelve small septa». I have examined the original specimens which are preserved in the Museum of Jardin des Plantes in Paris and these do not present the least trace of septa and correspond to the figures.
1854. Fistulipora decipiens, M. EDW. & H. Brit. Foss. Cor., p. 298.
1854. » » M'COY. Contrib. Brit. Palæontol., p. 172.
1860. Heliol. interstincta, FERD. ROEMER, Tennessee, p. 23, Taf. II, fig. 5, 5*a*. The enlarged figure, 5*a*, clearly shows the identity.
1873. Fistulipora decipiens, I. W. SALTER. Catal. Foss. Cambr. p. 103.
1878. Heliol. interstincta, QUENST. Petrif. p. 143, pl. 148, fig. 25 (enlargement of coenenchyma falsely drawn).
1878. Heliol. megastoma, ID. Ibid. p. 143, 144, pl. 148, fig. 27, 30, 31.
1880. Heliol. Murchisoni, NICHOLSON and ETHERIDGE, Girvan p. 244. They say that it is closely allied to Hel. porosus and nevertheless they describe it as wanting septa.
1880. Heliol. interstincta, ID., ibid. pl. XVI fig. 3, 3*a*, 4, 4*a*.
1883. Heliol. decipiens, LINDSTRÖM in RICHTHOFEN's China, Bd IV, p. 56, pl. V, fig. 6.
1885. Heliol. pyriformis, DAVIS, Kentucky Fossil Corals, pl. I, fig. 5, 6.
1885. Heliol. subtubulatus, ID. Ibid. pl. I, fig. 7—8.
1888. Heliol. decipiens, LINDSTRÖM, List of U. Sil. Foss. of Sweden, p. 21.
1891. Fistulipora decipiens, WOODS, Catal. Type Spec. Cambridge, p. 18.
1895. Heliol. decipiens, WENTZEL. Zoanth. tabulata p. 33, Tab. IV, fig. 2—9.
1895. Heliol. bohemicus, ID. Ibid. p. 31 Tafl. I, f. 8—9, Tafl. II, f. 1—4.
1895. » » var. major, ID. Ibid. p. 33, Tafl. III, f. 8—9, Tafl. IV, fig. 1.

There are local varieties in great abundance. From the stratum *c* of Tofta Gotland we have semiglobose colonies with calicular openings rather more distant than else. The circular, non indented wall raised a little above the coenenchyma, which is faintly elevated all around it or rather there is a minute mound of the coenenchyma with the calicle on the top.

From the Arachnophyllum stratum near Wisby there is a variety, growing in disks of the vertical thickness of 25 mm. The calicles are small, circular, distant, 4—5 millims apart and 0,5 mm. in diameter. The abundant coenenchyma is very finely reticulated, with tubuli of regular sixsided shape.

There are in all at least five variations.

1. Interior side of the theca quite smooth and small calicles.

2. Quite smooth inside, calicles large, densely placed. From the Ohhesaare pank in Ösel I have seen a variety between 1 and 2 in the Museum of Reval.

3. Small indentations in the theca, calicles small, much distantiated from each other.

4. Large calicles, closely set, indications of septa, coenenchyma partly irregular. To this belongs Heliol. bohemicus of WENTZEL. I cannot but find that it is only a variety of interstinctus or intermediate between this and the genuine decipiens. I have had Bohemian specimens for examination. WENTZEL admits in his description the great variability in size and in the thickness of the theca. The chief difference from decipiens lies according to him in »das Coenenchym ist sehr unregelmässig ausgebildet». The size of the calicles is of no account at all as specific character, as in many instances has been shown, that the same surface bears calicles of greatly deviating size. Moreover, I have specimens presenting on one side the »bohemicus» feature, on the other side the regular interstinctus coenenchyma. This variety also occurs at Taggamois, Undwa, stratum I of the Island of Ösel.

5. Large calicles, closely set, indications of septa and regular coenenchyma. To this variety belongs the Eiflian specimens, mentioned above. All these five varieties have been found in the Gotland strata. I have also received specimens from Chicago by Dr HEAD, from Louisville Kentucky, named Hel. subtubulatus and even Plasmopora follis, from Ta-pa-shan, Schenzi China by Baron RICHTHOFEN. In Sweden it also occurs in Norderön, Jemtland and the »Riks Museum» is in possession of specimen from the upper-silurian of Öfveds kloster in Scania. Some calicular tubes attained a great length, one holding 56 millim. all along with or breadth of 2 mm.

Much on account of the pretended affinity with MAC COY's Fistulipora and still more through a false appearance of coenenchyma in such genera as Callopora, Dybowskiella, etc. a supposition of affinity between these and the Heliolitidæ has been most positively maintained by several authors, especially by DYBOWSKI, WAAGEN, NEUMAYR and with some hesitation also by NICHOLSON. Here is not the place to enter into any lengthened discussion upon this point, as it will require a most detailed research of longer duration of time than I now can dispose of, nor is it at present much need of it, since of late several authors, as for instance ROMINGER, JAMES, ULRICH, SAMPSON and GREGORY, have definitely ranged amongst the bryozoa nearly all those fossil species which the former insisted upon to regard as corals.

The principal questionable forms have been referred to Monticulipora, Callopora, Fistulipora and so forth. But there prevails a great confusion as to the limits and names of several of them. What WAAGEN has called Dybowskiella is Lichenalia for the American

authors and Fistulipora according to NICHOLSON.[1] The chief differences in structure which make it impossible to see affinities between the Heliolitidæ and the above mentioned genera may here be enumerated.

1. Amongst the Heliolitidæ we do not find the least traces of acanthopores so significant to palæozoic bryozoa.

2. There are on the surface of the Heliolitidæ never any »maculæ» nor »monticuli».

3. Their calicular apertures are never closed by false »opercula».

4. The intimate microscopical structure is in both groups dissimilar. In the Heliolitidæ it agrees with that which is seen in most recent or fossil corals, consisting of diminutive fibrillæ, which are directed upwards from their starting point, while those of the bryozoa are directed downwards. See numerous instances in the works of NICHOLSON, DYBOWSKI and others where sections of bryoza are given.

5. In the bryozoans there have never been discovered the least traces of any structure at all to be regarded as homologous with septa. In Dybowskiella (= Lichenalia) for instance, which according to WAAGEN, is a true coral and nearly related to Heliolites, he states that there are two septa.[2] But these so called septa are nothing else but the »lunarium» or »lunula» so characteristic for many both palæozoic, mesozoic and probably also recent bryozoa. This structure occurs in the palæozoic genera Lichenalia (= Dybowskiella), Fistulipora, Coscinium, Ceramoporella and many others, in the mesozoic (jurassic) Chilopora, in Salicornia from the Oligocæne formation, in Lepralia from the Crag and recent seas. It is a crescentic plate or incrassation below the aperture of the zooœcium formed by its peristome and of course of variable shape in the different genera, but all homologous and referable to the same type. In some of the sections figured by WAAGEN it seems to have been detached from the peristome lying loose beside it and has probably been altered through pressure in the rock.

6. The bryozoa have no coenenchyma in the same sense as Heliolites and the interspace or tubes between the zooœcia are now considered as absorbed zooœcia and termed mesopores. There are also »intravesicular tissues». WAAGEN has not given decisive proof that what he calls coenenchymal gemmation in Dybowskiella proceeds in the same manner as in Heliolites.

7. There is a decided dissimilarity between the interior structure of the bryozoa and the Heliolitidæ, many of the former having imperfect diaphragms, and they are provided with the characteristic cystophragms.

Heliolites porosus. GOLDFUSS.

Pl. II figs. 29—37. Pl. III figs. 3—7.

1770. Héliolithe pyriforme GUETTARD. Mémoires sur différentes parties des Sciences et des Arts, vol. 2 p. 429 pl. 22 f. 13—14, vol. 3 p. 454. Specimens from Eifel. He considers Madrep. interstincta of LINNÆUS as identical.

[1] Tabulate Corals pl. XV, f. 3*a*.

[2] Palæont. Indica, Foss. Productus-limestone XIII, p. 917 etc., pl. CII, fig. 3.

1805. In HÜPSCH's »Naturgeschichte des Niederdeutschlands, Zweiter Theil, Vorläufige Abbildungen», containing only plates without any descriptive letterpress, as it was edited after the decease of HÜPSCH by the Raspesche Buchhandlung in Nürnberg, the figures 49—52 represent this species in natural and enlarged size, without giving any denomination.

1820. Madreporites stellatus SCHLOTHEIM, Petrefaktenkunde I, p. 362.

1826. Astræa porosa GOLDFUSS, Petref. Germaniæ, p. 64, pl. 21, fig. 7.

1833. Heliopora pyriformis STEININGER, Observations sur les Fossiles du Calcaire intermédiaire de l'Eifel. Mém. Soc. Geol. de France I, p. 346.

1834. » » BLAINVILLE, Manuel d'Actinologie, p. 392.

1837. Heliopora interstincta BRONN, Lethæa Geognostica, p. 48, pl. V, fig. 4*a*—*b*. Several species mixed.

1840. Porites pyriformis LONSDALE apud SEDGWICK and MURCHISON, Physical Structure and older stratified Deposits of Devonshire, Transact. Geol. Soc., II[d] Ser., V, p. 697, pl. 58, fig. 4, 4*a*—*f* and Explan. of figures.

1841. » » PHILLIPS, Palæozoic Foss., p. 14, pl. 7, fig. 19*a*—*c*.

1843. Porites porosa F. A. ROEMER, die Versteiner. des Harzgebirges, p. 4, Taf. II, f. 9*a*—*b* (mala).

1844. Porites pyriformis, FERD. ROEMER, Das rheinische Uebergangsgebirge, p. 58.

1848. Heliopora piriformis BRONN, Index palæont. Nomenclator, p. 574.

1850. Geoporites Boloniensis D'ORB. Prodrome, p. 108 ?.

1850. Geoporites Phillipsi D'ORB. Prodr., p. 109.

1851. Heliolites porosa M. EDW. & H. Pol. palæoz., p. 218.

1851—56. » » SANDBERGER, Verstein. Rhein. Schichtensystems, p. 407, pl. XXXVII, fig. 1, 1*a*, 1*b*. Specimen interiorly crushed.

1851. Palæopora pyriformis MAC COY, Brit. Palæozoic Foss., p. 67.

1853. Heliolites porosa M. EDW. & H. Brit. Foss. Corals, p. 212, pl. 47, f. 1—1*f*.

1860. » » IID. H. Nat. Cor. III, 235.

1876. Heliolites porosus FERD. ROEMER, Lethæa geognostica Atlas, Taf. 26, f. 2*a*, 2*b* (mala). The descriptive letterpress is of later date, 1883, 1[r] Bd 2[e] Lief., p. 509. In the same he gives, p. 504, a figure (120*b*) of Heliol. megastoma, which, however, seems to belong to Hel. porosus. The description also contradicts this figure as there is stated that »die 12 Sternlamellen *wenig* entwickelt». Moreover it is quite impossible to coordinate the longitudinal section in fig. 120*c*, with the transverse section in *b*, as of necessity the well developed septa must be seen in the former.

1876. Heliol. porosa ZITTEL. Handb. der Palæont., Abth. 1, Bd 1, p. 213, fig. 123*a*—*c* (original).

1878. » » QUENST. Petrefaktenkund. Bd I, p. 138, pl. 148, f. 15—22, fig. 24 scarcely belongs to this species.

1879. » » NICHOLS. & ETH. Corals of N. Queensland, Ann. Mag. N. H. Ser 5, vol. 4, p. 223.

1880. » » IID. Silur. Foss. Girvan, p. 244.

1880. » » GOSSELET. Esquisse Géol. du Nord de la France, pl. III, fig. 15, 15*a*.

1883. Heliol. porosus VON KOCH, Ungeschlechtl. Vermehrung palæoz. Korallen. Palæontogr., XXIX, p. 333, pl. 43, fig. 1—11.

1885. Heliol. porosa MAURER, Fauna von Waldgirmes, Abhandl. Hessischen Geol. Landesanstalt, p. 79.

1889. Heliol. interstincta CH. BARROIS, Faune calcaire d'Ebray, p. 30, pl. III, fig. 6*a*—6*b*.

1889. Hel. porosus NICHOLSON, Palæontology, I, p. 336 f. 217, *C*, *D*.

1890. Hel. concentricus ROMANOWSKI, Materiali geologie Turkestan etc., p. 7, Tab. VII, f. 3, 3*a*.

1890. Hel. solidus ID. Ibid., p. 6, pl. VII, f. 2, 2*a*, pl. XIV, f. 3.

1894. Hel. porosa PENECKE, Grazer Devon, Jahrb. k. k. Geol. R. Anst. Bd XLIII, p. 591.

1895. Heliol. pyriformis WENTZEL, Tabulaten, p. 28.

1896. Heliol. porosus SARDESON, Tabulaten, N. Jahrb. f. Min., p. 263, fig. 7—10.

This since long times known coral, so often described and figured, might seem to have no need of further investigation. Still there are some points in its structure and development which may be a little closer ransacked.

Form of polypary sphærical or tuberous, covered with calicles and coenenchyma everywhere and consequently with no or very little epitheca.

Calicles. Perhaps in no Heliolitidean there exists so great a difference in size between the calicles as in this species, as MILNE EDWARDS and HAIME already have stated in their Brit. Foss. Corals pl. 47, figs. 1*a*, 1*b*, 1*c*, all from the surface of the same specimen. They vary from 2 mms. to a little less than one millimeter. The theca or inner wall is remarkable for its thickness, being somewhat exsert, and contrasts in this respect with the interior theca of Heliol. interstinctus, which is thinner and deeper indented.

Septa. The size of the twelve septa is also much variable. Seldom they are so long and attenuated as in pl. II fig. 30 or as also SARDESON figured them. Even in the same polypary all gradations may be seen (pl. III figs. 5—6) from those which nearly meet in the centre, ending in a sharp point (never, however, uniting so as to form such an intricate network so characteristic for the nearly allied Heliol. parvistella) to such which stretch only halfways from the interior wall and leave a nearly circumscribed area enclosed in the centre between their ends. And lastly there are septa (pl. II fig. 32, pl. III f. 5 the right calicle) that almost remind of those in Heliol. interstinctus. In the last mentioned species the septa are equalsized, but in Heliol. porosus they often are regularly alternating short and long. Pl. II fig. 29. It is as if they, like »Hexacoralla», had two cycles, each of six septa of different orders, but there is no cause to assume that they are not coëval. We have no indication of only six septa in the young polypierite. As a further distinction from Heliol. interstinctus may be mentioned that H. porosus never bears the columella-like protuberance, which adorns the centre of the calicle in the former.

The septa are no mere septal spines, as so often has been asserted, but are coherent lamellæ, having their edges obtusely denticulated, as shown in the fig. 36 pl. II. But they may also (pl. III f. 7) have the margins fringed with slender curved spines or cusps reaching not quite to the centre.

The *tabulæ* are generally regular, but also often distantiated and deviating from the horizontal.

The *cœnenchyma* has polyedric tubuli with rather thick walls and of small diameter.

The intimate microscopic structure (pl. II figs. 33, 34, 35) consists of three strata, a very narrow, central one enclosed within two larger, of similar structure, on each side.[1] The central stripe is of white colour, in transparent light looking black, quite as is the case of what I formerly have called the primary streak or primary septum, with which

[1] Already QUENSTEDT, Petrefaktenkunde I, p. 138 pl. 148 fig. 15*y*, had observed what he calls the double wall and its dividing line in Hel. porosus. SARDESON, Tabulaten p. 267 fig. 10 has seen the stripe only in the theca and regards it as a dividing line of the double wall. The fibrillæ he calls a »krystallinische Structur». WEISSERMEL, Deutsche Geol. Gesellsch. 1898, p. 61 and 63, fig. 3 & 4, has seen the »Primärstreif» both in the theca, the septa and the coenenchyma in Hel. porosus, and as he says in Hel. interstinctus from Gotland, which probably not is interstinctus on account of the long septa, the fibrillæ were not clearly seen by him.

I regard it as homologous, as well as with Miss OGILVIE's centres of growth. I have not been able to detect any structure in this central stratum, it seems to be homogenous. The two lateral strata consist entirely of minute fibrillæ, which in a longitudinal section are directed upwards from their basis, be it on the exterior or the interior side of the theca. The septal lamellæ consist of such, as well as the coenenchymal tubuli. But there is no double wall to the calicle for itself, it shares the outer moiety with the adjacent tubuli, which also share their walls with the adjacent ones. The median stripe is common to them all, radiating without interruption between all calicles and all tubuli, it is, as it were the primary sceleton of the polyparium. Only the septa, which present themselves as direct offshoots from the interior stratum of the theca and entirely dependant of this, consist of two strata, indistinctly divided by a white stripe which apparently communicates with the central stripe. To judge by this, joint with the observations of the small initial polypierite, the usual rule, that it is the septa which form the wall by uniting their exterior parts, does not hold good here and it is on the contrary the wall or theca, which is the primary part from which the septa grow out as well as the coenenchyma. The distinct strawcolour or pale yellow which characterizes all the vertical constituents of the polyp sceleton in Heliolites viz., thecæ, septa, septal spines and walls of the coenenchymal tubuli, testifies to the common origin of all.

Gemmation. The only one which I have been able to observe in this species is the coenenchymal. The seven sections pl. II fig. 37, I—VII, represent the successive changes of two calicles, by a happy coincidence actually found beside each other. This series of sections was obtained by cautiously rubbing down from the surface a portion of an Eiflian specimen having the aspect as presented in fig. 37, sect. VII. The entire length thus abraded from VII to I amounts to 1,2 millim. In the deepest section I, to begin from the beginning, we find to the left a perfect, fully developed calicle and at right the common coenenchyma, of which, however, two or three tubuli seem affected, having a deeper tinge. As the changes in these two series of calicles are diametrically opposite we leave the left one, to continue with the budding one. In section II seven tubuli are affected, of them the two lowest, the same as in I, have grown larger; six are grouped round a central one. They grow still more in size, sect. III, and the central one as well as the two tubuli right of it are much changed, the walls between them partially broken and vanished, reduced in size, dwindling to threadlike thinness from at first being thick. The first indication of septa is visible on the right side in a bifurcation which in the next stages has grown out into two septa. A step further in sect. IV, all walls towards the centre, where it is an open space, have been absorbed, there is free intercommunication between all seven tubuli now changed into open compartments between their lateral thecæ, changed into narrow, irregular septa eight or nine, and the whole is surrounded by an incrassated border, the first irregular indication of the future theca, partly formed of the remaining fragments of tubular thecæ, but, however, not regularly circular. Two more tubuli, one in the uppermost left corner, one in the lowest, have been attracted within this sphære of change and out of these have, sect. V, been formed two new loculi and the number of septa is complete, though they are of much unequal size owing to their successive appearance. Some are formed out of old tubuli walls, others, the smallest, are formed anew and grown out of the theca. In VI the new

calicle is nearly ready, the shape of its theca is not circular and the septa are irregular in their size and direction. In VII we have the calicle fully developed and regular. The lacuna on the left side is incidental.

The description given by VON KOCH of the coenenchymal gemmation in Heliolites porosus does not agree with my observations. He says that about twelve tubuli covering a circular surface *at once* and at *the same time* arrest their growth and cover themselves with a common tabula and instead of them a calicle appears *directly* built in the normal manner. I suppose he has been misled by such sections as those represented on his pl. XLIII figs. 7 & 8. Nor can I find how the figs. 9—11 could show the gemmation. If f. 11, according to him, is the oldest and fig. 9 the uppermost or youngest, there is rather the contrary of the gemmation or a destruction of the calicle through change back again into coenenchyma as I am going to describe a few lines below and have delineated on pl. II fig. 34. It is evident that NICHOLSON's representation of calicular gemmation in Hel. porosus (page 336 Man. Palæont. 3[d] Ed. fig. c *au'*) is nothing else but the same deterioriation of the calicle. The theca is too perfect to belong to a budding calicle on that stage. Compare pl. II fig. 37, sect. v to the left in my memoir.

We have now contemplated how a new calicle originates, let us now turn to see how a mature calicle degenerates and again turns into coenenchyma from which it was derived. In sections I and II there is no change in the regular shape. The change sets in in III by disorderly growth of some septa at right, as if they were affected by the alterations going on next it, where the first new septa begin to appear. They acquire a new shape or coalesce and so it continues in IV till in V the right moiety is completely destroyed and transformed into a reticular tissue of tubuli which have grown out of the altered septa and it has been converted into coenenchyma. At the left side five or six septa are still visible, but have grown longer and coalesced with each other and formed tubuli. In VI the whole has turned into coenenchyma of an irregular appearance, and at the surface, of the corallum, VII, it is changed into a regular coenenchyma where all vestiges of the lower buried calicle are effaced.

Both these parallel, collateral series of sections were taken at a distance of 0,1 mm. from each other. The distance between sections VI and VII is 0,6 millim.

In figs. 3—4 pl. III another instance is given of this selfdestruction of the calicles. In fig. 3 the calicle has proceeded far in the coenenchymal metamorphosis, the fig. 4 showing the appearance of the same calicle a little below the former. This change is in contradistinction to another of the same effect, when the coenenchyma incroaches upon the calicular area and destroys it by overwhelming it.

Metamorphic agencies have been at work in the interior of the polyparia. As it is possible by degrees to follow the alterations, no mistake can be made to attribute to organic structure what is in fact inorganic destruction. Thus in a transparent section at one side where the structure is intact the calicles have their twelve septa. In an intermediate patch between this and the metamorphosed region the calicles have partly lost some septa and the rest is mutilated, while on the metamorphosed side they are like the calicles of Hel. decipiens. The regular outlines of the calicles and the normal form of the septa left in situ on the one side prove, however, sufficiently that this change is caused by other than organic changes.

This species ranges widely from the Alpi carniche in Italy to France, Ebray, St. Germain de Fouilloux in Mayenne, Belgium (Petigny), England Torquay in Devonshire, Germany in many places of its western countries, especially Eifel, but also in Nassau, Westphalia and the Harz mountains.

Its geological horizon is Lower and Middle Devonian in which it is found as high up as in the Stringocephalus beds.

Heliolites Barrandei. PENECKE.

Pl. III figs. 8—12, 17—27.

1887. Hel. Barrandei (R. HÖRNES nomen nudum) PENECKE. Fauna . . . paläozoischer Korallriffe der Ostalpen. Zeitschr. d. deutschen Geol. Gesellsch. Bd 39, p. 271. Taf. XX, fig. 1—3.
1888. » » FRECH. Ueber die Altersstellung des Grazer Devon. Mittheil. d. NW. Vereins Steiermark, p. 6.
1894. » » PENECKE. Das Gratzer Devon. Jahrb. k. k. Geol. R. Anst. Bd XLIII, p. 591.
1895. Pachycanalicula Barrandei WENTZEL. Tabulaten p. 23.

Mode of growth. This very common species has grown in large, flat or slightly domeshaped disks with a thin, wrinkled epitheca on the inferior surface.

Calicles generally small, at the highest attaining only one millimeter in diameter, those from the oldest strata only 0,5 millim. Their theca does not project above the surface of the corallum or only very little; it is regular and not much indented.

Septa well developed, rather thick and short, at their interior end they send off thick, blunt spines upwards and the centre of the calicle is occupied by the tops of lower situated septal spines, which sometimes cause a false appearance of a columella. The longitudinal sections fig. 12, 16, show how they continue upwards and fill the central space of the calicle. These numerous septal spines, issuing from the margins of the septa (fig. 20), are of an irregular growth, but always tending in a bow upwards from their basis, sometimes meet in the central axis of the calicinal tube, where they form an intricate tissue. Some, especially the younger varieties of the Upper Silurian and the Devonian ones, have a slight swelling in the apex like a little globule.

Tabulæ. These are rather scarce and much distantiated, surrounding the large spines, which have grown in advance of them. They are else regularly horizontal.

Coenenchyma. Its tubuli are upon the whole more regularly polyedric than in the former species, though in some of the varieties from the higher Upper Silurian strata and the Devonian polyedric tubes are mixed with rounded or irregular ones (pl. III, fig. 22 & 24). Dr PENECKE has stated that the walls in these tubuli are of great thickness. The sections which PENECKE has figured in his above cited paper seem to me to have been derived from specimens which have been subject to much pression and thence assumed their peculiar oblique aspect. The calicles in these are ovale or oblique, deviating from the regular circular shape in some specimens. In others again, which I owe to the liberality of Dr PENECKE the regularity is predominant. I have given a figure of such, pl. III f. 24—25, showing quite regular coenenchymal tubuli. A longitudinal section (pl. III f. 25) has by no means thicker walls than the Swedish specimens and the thick ones seen in fig. 25 are entire

walls of the theca, lying parallel with the surface of the section, and consequently not cut but seen »en face». This partial dilatation of the tubuli walls caused WENTZEL to create a new genus Pachycanalicula for these forms. I do not think that this can be considered as a so fundamental diagnostic, as to be adduced for basis of a new generic division. If so it should be a permanent feature in the structure of the coral, not a transient or mutable one.

The tabulæ are rather more scarce and more distantiated than in the other species. In several specimens they are both on the superior and inferior surface covered with a dense coating of minute blackish crystals (pl. III fig. 26) probably of pyrite, and the thin tabula shines in the middle between them as a white streak. It may be this circumstance that has occasioned an opinion expressed by some author that the tabulæ consist of two layers and the white line (the true tabula) to be their dividing line.

The distinction in colour between the septal and dissepimental elements are much clearly seen in the longitudinal sections, perhaps more so than in other forms. The longitudinal thecæ, septa, spines inclusive, are of a pale strawcolour, the tabulæ black in transparent light, white in reflected light. This points to some chemical or even structural (histological) fundamental, difference, between these two elements.

The microscopic structure (transverse section, pl. III f. 23) consists of the fibrillæ on both sides of the white streak, and they stand forth as integral parts of the theca without sign of any dividing line.

Propagation. The only manner I have observed is the coenenchymal gemmation, as delineated in pl. III; fig. 27, sections I—IV. It proceeds nearly in the same manner as in the other Heliolitæ. In II three new septa are already formed and part of the theca out of the walls of the surrounding tubuli, in III there are septa and scattered fragments all round in the well circumscribed calicle. In IV it is nearly complete, but of oval outline.

This species ranges from the lowest Upper Silurian into the Upper Lower Devonian of Austria. It has been found copiously in the Silurian strata of the Isle of Gotland from those signed *a.* to *f.* inclusive. There is some little dissimilarity between the specimens from the oldest beds and those from the top, the latter having larger calicles, but it is of slight signification.

It has been found at the following Gotland localities. In the Arachnophyllum stratum, *a*, near Wisby. In the stratum *bc* at Atlingbo canal, Stora Carlsö, Skäret in Fröjel, Gnisvärd and Vägume vik, Petesvik Habblingbo.

In the stratum *d.* at Lansa, Alnäse, Dember and Ryssnäs in Fårö, Wisby, Dalhem, Klef in Sundre.

In the stratum *f.* at Sundre, Hoburg, Sandarfve kulle, Löjsta klint, Mallgårds klint, Lilla Carlsö, Follingbo, Bara backe, Gothem, Tjelders in Boge, Slite, Wägume vik, Longume and Pafvals in Lärbro, a quarry near Lärbro church, Helvig on fields, near Bunge church, Alnäse in Fårö. At Lau, Bondarfve backe in Burs, Klinteberg.

Through the kindness of the late Prof. JAMES HALL I have received specimens from the Falls of Ohio.

I have also examined specimens from the »Oberes Unter-Devon: Zone Heliolites Barrandei» near Graz in Austria.

Heliolites Barrandei, varietas *spongodes* n.

Pl. III fig. 13—16, pl. IV, f. 1.

1880. Heliolites micropora NICHOLSON & ETHERIDGE. Girvan p. 245. This is identical with my var. spongodes, which I formerly had confounded with Heliol. micropora EICHWALD and sent to Prof. NICHOLSON under that denomination. Having through the kindness of Prof. INOSTRANZEW been able to examine the original specimen of EICHWALD, preserved in the Museum of the University of St. Petersburg, I have found that this is a Coccoseris, which has been described further on in this memoir.

Mode of growth. Polypary grown in spongelike, irregularly lobate masses expanding from a narrow basis, having short fingerlike processes from the rounded edges, and with calicles on all sides. There are only a few undulating stripes of epitheca formed by and by as the coral has advanced upwards and covering the older calicles.

The *calicles* are extremely small, scarcely 0,5 millim. in diameter. Their theca is slightly prominent, very little indented.

The *septa* are of unequal size, some reaching to the centre, where a few detached tubercles fill the space, being the ends from lower situated septal spines. The septal laminæ are, quite as in the typical species, split up in narrow, upwards curved spines, enclosed by the horizontal and distantiated tabulæ.

The *coenenchyma* consists of very small and narrow polygonal tubes.

This very characteristic and distinct local variety occurs only in the strata *b*—*c* in the Wisby region, seldom in the lowest beds of *d*, and ranges from Wible, past Wisby, Snäckgärdet towards Likkershamn. Only one specimen has been found in the stratum *c* at Djupvik in Eksta and nowhere else.

Another variety of a singular mode of growth has been found in the uppermost strata of Sandarfve kulle. Pl. IV, fig. 1. It has grown in narrow branchlets of a width of 4—5 millims. The calicles are totally concordant with those of the genuine Heliolites Barrandei and occur on all sides of the polyparium. It reminds somewhat of Heliolites inordinatus LONSDALE (British Fossil Corals, p. 253, pl. 57, fig. 7) but this has more slender, regularly cylindrical branchlets and the calicles have, to judge by the figures, longer and more regular septa.

Heliolites parvistella. FERD. ROEMER.

Pl. III f. 28—31, pl. IV f. 2—9.

1861. Hel. parvistella FERD. ROEMER. Sadewitz, p. 25, Tab. IV, f. 6.

1878. Hel. conf. Murchisoni QUENSTEDT. Petrefaktenkunde, p. 143, pl. 148, fig. 29. The appearance of the calicles make it probable that this is identical, but a longitudinal section is wanted to make it certain.

1880. Hel. interstincta NICHOLSON & ETHERIDGE. Girvan, p. 254, pl. XVI, fig. 1*a*, 2*a*—2*b* cet. excl.

1880. Hel. interstinctus, var. lamellosus LINDSTR. Fragmenta Silurica, p. 32, Tab. I, fig. 5.

1883. Hel. parvistella FERD. ROEMER. Lethæa geogn., p. 506.

1888. Hel. inordinatus LINDSTR. Fossil Faunas of Sweden, II, p. 21.

1895. Stelliporella lamellata WENTZEL. Tabulaten, p. 34, Tab. IV, fig. 10—12.

1895. Heliol. parvistella ID. Ibid., p. 29.

At present it must be left undecided whether the following names belong to this species or not.

1860. Hel. interstinctus EICHWALD. Lethæa rossica I, 1, p. 453. His description »12 lames verticales pénétrant jusqu'au centre» shows that his specimen cannot be H. interstinctus, but possibly belongs to this species.
1876. Hel. interstincta ROMINGER. Corals of Michigan, p. 12, pl. 1, fig. 1.
1885. » » FERD. ROEMER. Lethæa erratica, p. 78, Tab. V, fig. 7.
1885. Hel. megastoma DAVIS. Kentucky Corals, pl. 1, fig. 1.
1885. Hel. interstinctus ID. Ibid., pl. 1, fig. 4.

Mode of growth. The polyparium is discoid or lamellar, the larger polyparia with protuberances from the superior or calicle bearing surface, no doubt originated through the intracalicular gemmation. These lamellæ are often very thin, having a vertical thickness of only three or four millimeters. The epitheca is finely wrinkled and glossy.

The *calicles* are at widest 2 millims. The theca forms outgoing angles between the loculi and ingoing angles opposite the septa, in consequence of what the whole assumes the shape of a star and the outline of the calicle more or less deviates from the circular.

The *septa* are long, stretching in some specimens quite to the centre of the calicle, in others forming in the centre an irregular network by combining, as it were, with their ends. In the former calicles (pl. III, figs. 28, 30, and pl. IV, fig. 2) there is also at the meeting of the septa an indication of the same reticulation through the curving and interlacing of their ends. Sometimes they are longitudinally bent in zigzag and with small spinules on the sides. In consequence of their meeting with their interior edges in the central axis of the calicular tube and because they there coalesce with each other no marginal spines have room for developing. For the same reason the *tabulæ* have rather the character of a dissepiment and they are not stretching in coherent lamellæ uninterrupted over the whole calicle, but are subdivided in the loculi and bent a little upwards or even downwards or as a convex lamella (figs. 29, 31, pl. III). Owing to this subdividing of the tabulæ in the loculi and to the prominence of the septal lamina in a longitudinal section it is very difficult in such a section to distinguish the calicular tube from the surrounding coenenchymal tubuli. In these, however, the dissepimental laminæ are most regularly horizontal. For the rest these tubes are regularly polygonal with very thin walls.

In many sections (figs. 3, 9, pl. IV) there is seen a very distinct difference in colour between the septa or longitudinal walls and the dissepiments or tabulæ, the former having in transmitted light a paler, nearly strawcolour and the latter being dark or black.

On the plates III and IV specimens from different localities have been figured to be compared with the original specimen of FERD. ROEMER (pl. III, f. 28). There is a specimen from the Upper Silurian of Oesel (pl. III, f. 30), one from Louisville in America (pl. IV, f. 2), one from Kozel in Bohemia (pl. IV, f. 5) and one from the Upper Silurian of Gotland (pl. IV, fig. 8). In respect to their structure, as revealed in longitudinal sections, there reigns the most complete conformity. Again in viewing the calicles on the surface or in a transverse section there seems at first to exist a great dissimilarity between them

for instance between figs. 28, 30, pl. III, f. 2, pl. IV on the one side and figs. 5 and 8, pl. IV on the other. But now calicles of the first type may be found on the surface of the same polyparium together with calicles of the second type, in which also the reticulation is more or less complicated or in other words variable. So in the Bohemian, as well as in the Gotlandic specimens. I therefore cannot agree with WENTZEL in considering the reticulated specimens as so highly differentiated as to justify their being removed into a separate generic type, called Stelliporella. As the chief and only distinguishing character of this genus can be shown to be highly variable and as for the constituting of a new genus must be wanted more than a single character and that too of constant value, I should at the highest attribute a varietal value to the Stelliporella-specimens.

From Heliolites Barrandei, the only one, with which it could be confounded, it is distinguished in the following manner.

Hel. Barrandei. PEN.	*Hel. parvistella.* F. ROEMER.
Septa not attaining the centrum of the calicle, at the edges bent upwards in spines.	Septa long, meeting in the centre of the calicle, where they intercross and form a more or less complicated reticulation.
Tabulæ regular, horizontal but scarce.	Tabulæ irregular, as it were, broken up between the loculi and curved upwards or convex.

Distribution. In Gotland it is one of the most common species and has been found in all strata. In the bed *a*, the Arachnophyllum stratum near Wisby, though not so common there as in the next superjacent beds *bc*, from Stora Carlsö, Westergarn, Petesvik in Hablingbo, Sproge, Stenbro å, Djupvik in Fröjel, the canal from Wisne myr in Fardhem, Asarfve in Hemse.

In the stratum *d* at Wisby, Stjernarfve in Eksta, Östergarn, Ryssnäs in Fårö. In the stratum *f* at Lau, Burs, Klinteberg, Sandarfve kulle, Fröjelklint, Lilla Carlsö, Follingbo, Wisby, the hill of Bara, Simunde in Bara, Slite, Klints in Othem, the shore of Boge, Tjelders in Boge, Kylley, Hidevik, near Bunge church. Also found in the Leptæna limestone of Dalecarlia in a few specimens at Östbjörka.

Its geographical distribution out of Sweden is also wide. The Swedish State Museum is in possession of specimens from the isle of Malmö near Christiania in Norway, from Kozel in Bohemia, from Dudley in England, from Louisville and the falls of Ohio in N. America, and from Pattakumäggi in the Island of Oesel, Russia. F. ROEMER found it in erratic blocks at Sadewitz in Silesia, which are derived from the uppermost beds of the Lower Silurian of Esthonia.

Heliolites parvistella, var. *intricata* n.

Pl. IV, figs. 10—19, pl. V, fig. 3.

Mode of growth. The corallum is arborescent or tuberous and there is scarcely any epitheca seen.

The *calicles* are, when fully developed, nearly circular with lobate edge through the indentations in the wall opposite the septa and very thin. The twelve threadfine septa are sinuous, some coalescing before they reach the centre of the calicle where they all join in an irregular net. The tabulæ are, as in the former, much broken up and hemmed in between the septal laminæ.

The *coenenchymal* tubuli vary much; they are regularly polyedric or they are of very different size (pl. IV, f. 11, 13, 14) many of them with small ribs or costæ shooting out into the tube (pl. IV, f. 11). They may also be much irregular, assuming all sorts of shapes (pl. IV, f. 13), meandring and curved.

Propagation. The coenenchymal gemmation may be observed on the surface of the polyparia as well as through transverse sections deep below the surface. Fig. 11, pl. IV represents the gemmation on the surface. It begins at first as a little shallow dimple pl. V, f. 3 all over covered by the meshes of the coenenchyma. In proportion as this shallow cup increases in size the meshes or tubes assume an irregular shape and when the incipient calicle has assumed a stellulate outline, as in the calicle farthest at left in fig. 11, most of the original tubuli have vanished, a few only linger still in the centre and from the lobate edge the beginning septa are directed centripetally. In the large calicle on the right, fig. 11, pl. IV, there are skeins of coenenchyma trending centripetally from the edges of the calicle, five or six on the right side. Between them a blank is left, a loculus, altogether six, or one between each skein. It is evident through the central calicle that these radiate accumulations of coenenchyma become transformed into septa, and they also make it manifest to us whence the sinuosity of the septa and their lateral thorns and ridges are derived, fig. 12, being in fact remnants of broken up coenenchymal tubuli. Thus it is also really evident that the central reticulations in the calicles of this species and so many others are actually coenenchymal tissue which has persisted unchanged there, while the other portions was metamorphosed into septa.

No law or rule common or equal for all Heliolitidæ in the manner of the coenenchymal gemmation can therefore be established. The suggestion that the formation of new calicles out of coenenchyma depends entirely on a reduction of several tubes, has only in a much restricted sense foundation in the natural procedure. On the contrary, as we have seen in this and in other instances, there is a formation anew and a transformation of preexisting parts into new ones.

Transverse sections at different depths of a polypary give, as seen in figs. 13, 14, 17, 18, pl. IV, various aspects of the calicles and the coenenchyma, unlike to that of the surface. Some as figs. 13, 17 remind of the coenenchymal gemmation and may also be such. A section fig. 19 of the base of the same specimen from which the other sections have been taken presents four calicles on different stages of development, not concordant

with that just described as occurring on the surface. This resembles rather more what obtains in the other species of Heliolites. We find by this that there are several modifications, even in the same species, of this mode of gemmation.

There is also evidence of intracalicinal gemmation in this species, as represented in fig. 15, pl. IV. The procedure seems to have been the same as described above in Hel. interstinctus, the median calicle being about to begin, the left one showing the next step and the right one being further advanced. In the central calicle a narrow belt of coenenchyma has been developed around the calicle. In the bottom of all these calicles, however, the coenenchymal tissue is still visible, and although not fully developed, they had already begun to bud.

This variety has been found chiefly in the shale beds (*c*) at Djupvik, Eksta, though there may be some specimens from a few other localities as at Lilla Carlsö, with a tendency to vary slightly towards the »intricatus»-type.

Heliolites hirsutus n.

Pl. XI, figs. 18—22.

It forms semiglobose masses with circular, densely crowded calicles having a diameter of 1,2 millimeters. The septa, as seen on the surface and in a transverse section, (figs. 18—19) have the short form as in Hel. interstinctus. Bases of spines are, however, observable as diminutive tubercles on their edge (fig. 18) and these are present in great numbers intact in the longitudinal sections (fig. 20) where they nearly fill the calicular tube, emanating from the narrow septal lamella and directed in a bow upwards and inwards, gradually tapering into a fine point. The thin *tabulæ* are in consequence of the numerous spines irregularly horizontal.

The scarce *coenenchyma* has the appearance common amongst the Heliolitæ though not so regularly polyedric and nearly only in one single row between the calicles. In a longitudinal section, owing to the preponderance of the calicles, it is difficult to find its tubes, but (fig. 22) they are narrow with distantiated, horizontal tabulæ. A remarkable feature, the same as observed in Proheliolites, is that a coenenchymal tube by degrees widens, is invested with septal spines and in fact is metamorphosed into a true calicle (fig. 22). This is a peculiar modification of the coenenchymal gemmation, as one coenenchymal tube is sufficient to perform this change.

This species shows affinities with Hel. Barrandei, but may be distinguished from it through the scarce and irregular coenenchyma, through the shape of the calicles and the spines, and moreover through its remarkable manner of budding.

It has been found in detached boulders at Hulterstad in Öland by J. G. Andersson and also at Skärlöf, the same island by Dr G. Holm. I have also had specimens from Worms, Piersal (F^1) and Hohenholm (Dagö) in Estland, Patakumäggi near Hapsal, Lyckholm, Kertel in Dagö, and a fragment also from Sandö north of Gotland. It is confined to the uppermost strata of the Lower Silurian of Sweden and Russia.

Heliolites fasciatus n.

Pl. IV, figs. 20—25.

Mode of growth. This species forms flat, discoid lamellæ attaining at the highest a thickness of 25 millimeters. The epitheca is finely striated by minute lines running parallel with the lines of growth.

The *calicles* are circular or nearly so, sometimes with thick, indented theca, only attaining 0,8 in diameter. The septa are thick, short, reaching only halfways to the centre (pl. IV, fig. 21); in the centre a sinuous columella-like protuberance. In a longitudinal section (f. 24) the septa are not visible. The irregularly distantiated tabulæ are more or less concave, but well developed. The columellar streak is partly visible, being present only at intervals.

The most peculiar feature is the banded appearance of the longitudinal section, some nine fasciæ, nearly parallel succeeding each other in a section (fig. 22). In fig. 23 a part of the coenenchyma is still more magnified. These fasciæ are a sort of compression or, as it were, a condensation of the tabulæ, which have heaped themselves, so as to be five or six on a distance of only 0,2 or 0,3 millim. while on the same distance else in the section there are not more than one tabula. These bands have a white colour, in transparent light black, whence they in the drawings also are black. Whatever may have caused this tightening of the coenenchyma at the same level along the whole polyparium and at regular intervals, being oftener repeated, however, near the upper surface, it occurs in all specimens which have been found of this coral and thus acquires the value of a regularly occuring phenomenon during its growth. In these bands the tubuli have divided more frequently than on both sides below and above. In a transverse section (fig. 25) taken through a fascia, great irregularity reigns, the coenenchymal tubes having all sorts of forms, the septa, three or four crossing the calicle in sinuous lines.

This species has been found in several specimens in the Arachnophyllum-stratum near Wisby and also at Westergarn.

Heliolites repletus n.

Pl. IV, figs. 26—31, pl. V, figs. 1, 2.

Mode of growth. This corallum has grown in large disks or semiglobular masses.

The *calicles* have a size of 1,2 millims. and are perfectly circular when fully developed having an indented, slightly exsert margin.

The *septa*, threadfine and sinuous in a not fully developed calicle (fig. 28), are in a mature calicle (fig. 29) straight, stretching near to the centre, where a small protuberance forms a sort of columella. It seems, to judge by the sections, that during the growth of a calicular tube there may be septa present some time and then wanting. (Figs. 30—31, pl. IV). This may coincide with changes nearly resembling those in Hel. fasciatus or with a tightening of the coenenchyma so as to form horizontal fasciæ. The coenenchyma, which

during the normal state of the polypary has the appearance figured on pl. IV, f. 29, assumes, when this peculiar modification of the constitution of the polyp sets in, a quite different aspect as shown in pl. IV, figs. 27, 28, pl. V, figs. 1, 2. The whole arrangement of the tubuli (fig. 27) becomes irregular, their dividing walls are sinuous and crooked, or even dissolved between contiguous tubuli. On the inside of the walls they are covered (fig. 28) with numerous, minute thorns and asperities. They increase in thickness and irregularity and are as unlike common tubuli of a Heliolites as possible. The figs. 1—2, pl. V represent the coenenchyma in this state. It is this change which is visible in the middle of the longitudinal section pl. IV, fig. 30, where it forms a narrow fascia. The septa also partake and lose their normal character, become sinuous, intertangled, coalescing, but are always twelve (pl. IV, fig. 27). Sometimes, when the septa are much reduced, the structure reminds of that of Hel. interstinctus in which, however, the characters are constant.

This species has been found in the shale beds *b*—*c* near Wisby, one specimen has been brought up from a depth of 5 metres in the harbour of Wisby, detached from the shale beds, which form the bottom there.

Heliolites Liljevalli n.

Pl. IV, figs. 32—34.

Of this curious and very distinct species only a single specimen has hitherto been found. It is disciform with a thickness of 10 millims. The *calicles* attain scarcely one millim. in diameter. The theca is stelliform, the angles facing the septa as deep as in Hel. parvistella. The *septa* are long though not all of equal size and reach to the axis of the calicle, which is excentric or a little on the side of the centre, whence the septa nearest the lesser moiety of the calicle are shorter. The *tabulæ* are highly irregular, oblique, wavy, convex and they have on their superior surface rows of stout spines which chiefly are visible in the longitudinal section (fig. 34), where also the septal laminæ and their composition of oblique fibrillæ are evident. The *coenenchyma* consists of the most minute tubuli that exist in this genus. They are of irregular section, seldom polyedric, elongated, bent, of varying size, though all very small. Their walls are thicker than in any of the other species and the distantiated tabulæ are concave. But the most peculiar feature consists in the numerous short ridges which project from the walls of the tubuli into their lumen, generally one in each tube, in some as many as three. By growing they divide the tube and through this fission form one or more new coenenchymal tubes. But they may also be present and continue almost through the whole length of the tube without initiating any fission. In the longitudinal section fig. 34 they are seen in the tubes at left. What is more strange, they are also found in the two calicles represented in the transverse section fig. 33, where they stretch in a loculus of each like a little adventitious septum.

This species has been found in the stratum *a*, the »Red Stratum», near Wisby, which has proved very rich in new and interesting forms.

I dedicate this remarkable species to Herr GEORG LILJEVALL, who through his great and renowned skill as a draughtsman and the keen perception of his eye has rendered the science so many valuable services.

Besides the above described species of Heliolites and their synonyms enumerated, there are several other names mentioned, as belonging to that genus. Some of these, as »Hel.» dubius and Hel. Grayi will be met with again as synonyms in other genera. Some others may be independant species, but I cannot describe them in particular, as I have not seen specimens.

Such are: *Heliol. Daintreei* ETHERIDGE and NICHOLSON, Ann. Mag. N. Hist., v ser., vol. IV, p. 224.

Heliol. plasmoporoides E. & N. l. c. p. 225, both from N. Queensland, Australia.

Hel.? parasitica NICH. & ETHERIDGE, Girvan, p. 259.

Hel. foliacea NICH. & ETH. l. c. p. 261.

Hel. macrostylus and *H. pyriformis* J. HALL, Pal. N. York vol. II, p. 135, 1, are probably identical with some of the Silurian species described above, but I have not been able to identify them.

Heliolites placenta has been described by M. EDW. & HAIME as a Devonian species. Its synonymy is the following:

1826. Coscinopora placenta GOLDF. Petref. Germaniæ p. 31, pl. 9, fig. 18.
1850. Geoporites placenta D'ORBIGNY. Prodrome, I, p. 108.
1851. Hel. placenta EDW. & H. Pol. pal. p. 219.
1860. » » IID. Hist. N. Cor. III, p. 237.
1866. Receptaculites Neptuni FERD. ROEMER apud GIEBEL, Repertorium zu GOLDFUSS' Petrefakten Deutschlands p. 6.

Professor CL. SCHLÜTER in Bonn has kindly communicated, that GOLDFUSS himself already gave this fossil a new name in his museum as Receptaculites placenta and he adds that it actually is a Receptaculites and no Heliolites.

Porites discoidea LONSDALE Sil. Syst. vol. II, p. 688, pl. 16, fig. 1, later in Siluria, 4th Ed., p. 510, called Heliolithes discoideus, has long ago been shown to be one of the Stromatoporidæ, in 1870 by me in a paper on the »Anthozoa Perforata of Gotland» p. 11 (Svenska Vetenskaps-Akademiens Handlingar. Band 9. N:o 6) and in 1886 by NICHOLSON in his Monograph of the British Stromatoporoids, p. 6 (Palæontogr. Society) who identified it as Stromatopora discoidea.

According to GOSSELET[1] a species of Heliolites has been found in the upper division of the Devonian formation at Engis, which locality by the Belgian geologists is placed in the group of the »Calcaire de Fresne», forming the lowermost beds of the Upper Devonian. To judge by the short description annexed by M. GOSSELET it is not quite certain that the fossil mentioned is a genuine Heliolites, but it may belong to an allied genus.

A few other names of Heliolites recur in the list of synonyms amongst species of the Plasmoporinæ.

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[1] Le Calcaire de Gîvet, Ann. de la Soc. Géol. du Nord. Tome VI, p. 11.

Gen. *Cosmiolithus* n. gen.

(Κόσμιον, ornament.)

Coenenchyma composed of a medley of small and larger tubuli of circular section, the former surrounding the larger ones. Their walls are very thick and the lumen is narrow with scarce, concave or oblique tabulæ. The calicles have a complete set of perfect, narrow septa, somewhat irregularly sinuous and in the centre, where they meet, forming a reticular tissue with open meshes. Owing to the great development of the septa, the tabulæ are seen only as small horizontal lines between them. The septal lamellæ are contiuous in their whole length and consist of fibrillæ. Both species hitherto known have grown in thin lamellar expansions.

From the genus Heliolites, to which it is most nearly related, it differs through its peculiar coenenchyma and the uncommonly thick coenenchymal walls. In respect to the septa and their arrangement it has a great resemblance with Hel. parvistella, but their structure is upon the whole different. What upon the first glance distinguishes this genus is the uncommonly narrow tubuli of the coenenchyma, the largest of which do not attain more than 0,1 millimeter in width.

Cosmiolithus ornatus n. sp.

Plate V, figs. 4—11.

The polypary has grown in thin incrusting lamellæ, scarcely attaining two millims. in thickness, bearing calicles only on the superior surface, the inferior being covered with a concentrically wrinkled epitheca. In a section this epitheca (fig. 10) shows a peculiar lobate appearance, being comparatively more corrugated than the smoother epitheca in other Heliolitidæ.

The *calicles* attain only 0,5 mm:s in diameter and their edge is incised by the angles facing the septa and filled with minute tubuli of the coenenchyma.

The *septa* in the calicle proper are well developed, straight, narrow, thickening downwards and form in the centre a reticulated tissue where they meet and, as it were, intertwine with each other. This central reticulation is tubular and in a longitudinal section its tubes cannot as to their structure be discerned from the larger coenenchymal tubuli, it is only by their position in the middle of the calycinal section they are recognized. The tabulæ are around the central reticulation of the calicle curved in a small bow upwards and continue more horizontal within the central tubes of the calicle.

The *coenenchyma* consists of two sets of rounded tubuli, f. 7, one more than four times as large as the other, which surrounds the larger one. Both are very tiny, the larger attaining a diameter of 0,1 millim., the smaller only of 0,02 millims. Deeper down below the surface, as seen in sections, f. 8, they have much thicker walls than could be appreciated from the surface, and they are filled with rather scarce, concave tabulæ, f. 10. Their walls, as

well as those of the calicles show in some places the same microscopic structure of fibrillæ, directed obliquely upwards, as seen in other Heliolitidæ and Corals.

There are some slight variations in the size of the calicles and in the thickness of the coenenchymal walls as seen in specimens from Wisby and Klinte (figs. 5 and 11), though the character in other respects is constant.

This beautiful species occurs in Gotland in the red layer *a* near Wisby and in the strata *b*, *c*, *d* of the same place, in the stratum *c* at Fröjel and Mölners in Klinte.

Cosmiolithus halysitoides n. sp.

Pl. V, figs. 12—18.

Polypary growing in thin lamellæ of 5 millimeters or less, bearing calicles only on the superior surface, the inferior one covered by a thin wrinkled epitheca having, when seen in a longitudinal section, a finely serrated edge (fig. 16). Its mode of growth is peculiar. In a specimen from Roma myr there are seven thin lamellæ above each other, the thickest of 5 mm., but all taken together 45 mm. These lamellæ are separated from each other through interspaces now filled with rock. But of these four of the lowest are connected in such manner that the upper one has grown out of next subjacent, tending obliquely upwards and sending out a new lamella in the same direction. It cannot be doubted that the three uppermost lamellæ also were in this manner connected, but the specimen is broken at one end. Only the two uppermost are thus connected. The *calicles* which attain a diameter of 1 mm are stelliform, the exterior wall being indented and invaginated forming acute angles where it faces the septa. The *septa* are rather short, continue towards the centre, where they form a sort of an extensive columella of reticulated tissue. The septa are in some calicles sinuous or even as if composed of minute tubuli (fig. 13). In sections of the calicles (figs. 17, 18) the broad septal laminæ form an exterior zone, showing the oblique arrangement of the elementary fibrillæ (fig. 18) and also the scarse concave tabulæ which continue into the narrow tubuli formed by the central reticulate meshes. The *coenenchyma* consists of two sets of tubuli one larger, of irregular oval shape with dense walls, and in these walls there are immersed the smaller tubes often in a chainformed series, giving an appearance as of an Halysites. In a longitudinal section the very thick and dense walls of the coenenchymal tubes are very prominent, enclosing the usual dissepiment of narrow, concave tabulæ.

It is chiefly the organisation of the coenenchyma and the excessive growth of the columellalike reticulation in the calicle that distinguish this species from the preceding.

It has been found rarely in the stratum *a* at Norderstrand near Wisby and also near the Roma myr, Gotland, in a detached specimen.

Gen. *Proheliolites.* Kiær.

1858. Heliolites Fr. Schmidt. Untersuchung Silur. Estlands, Archiv, p. 228.
1897. Proheliolites Kiær. Faunistische Uebersicht der Etage 5 des Norwegischen Silurgesteins, p. 10 (nomen nudum).

Corallum consisting of minute circular calicles with twelve septa, the basis of which resembles that of Heliolites, but the spines that are attached to them at regular distances are directed downwards, contrary to what is prevailing in all other Heliolitidæ. The coenenchyma is of the scarcest kind and only a few single tubes are found between the calicles. A single tube, which has the tabulæ more close than the calicles, can by expanding be changed into a calicular tube. Lower Silurian. As to its systematic place it ought perhaps on account of its great structural deviations from other corals form a family of its own, but it may stand as an appendix to the Heliolitidæ with which it else shows the greatest affinity.

Proheliolites dubius. Fr. Schmidt.

Pl. xi, figs. 10—17.

1858. Heliolites dubia Fr. Schmidt. Untersuch. Silur. Estlands, Archiv, p. 228.
1861. » » Ferd. Roemer. Sadewitz, p. 26, tab. iv, f. 5—5*a*.
1861. » » Törnquist. Lagerföljden i Dalarne, p. 19.
1873. Heliol. favosus Lindstr. (nec M'Coy). Svenska Undersil. Corall. p. 23.
1879. Hel. dubia Dybowski. Chætetiden der Ostbaltischen Silurformation, p. 113, tab. iv, f. 2—2*a*.
1880. Heliol. dubius Ldm in Angelin, Fragmenta Silur., p. 32, tab. i, figs. 1—4.
1880. Hel. dubia Nichols. & Etheridge. Girvan, p. 250.
1883. Hel. dubius Ferd. Roemer. Leth. Geogn., p. 505.
1885. » » Id. Leth. erratica, p. 313, Taf. iv, fig. 13 *a*, *b*.
1888. » » Lindstr. Fossil Faunas Sweden, i, p. 23.
1889. » » Nicholson. Manual Palæontol., i, p. 336, fig. 217 *A*, *B* (upside down).
1894. Hel. dubia Weissermel. Korallen Silurgeschiebe Ost-Westpreuss., p. 666, pl. liii, figs. 4*a*, 4*b* (these figures do not show the real characters).
1895. Heliolit. dubius Wentzel. Zoanth. tabulata, p. 30.
1896. » » Sardeson. Foss. Tabulaten, p. 270, figs. 11—12, p. 285, fig. 19.
1897. Proheliolites dubius Kiær. Faun. Uebersicht der Etage 5, p. 10 (without description).

The coral generally has grown in sphæroid and even semiglobose masses with a flat basis, in the former cases with calicles on all sides. A specimen from Lissberget in Dalecarlia measures 10,12 cm. by 9 cm. A characteristic feature in this species is that the small and as a rule perfectly circular calicles are so closely crowded that there is very little coenenchyma between them. They have a diameter of 0,8 millim. In some instances, even on polyparies, which for the rest have quite normal calicles, some of these (fig. 12) are irregular, almost polyedric, contiguous, without any coenenchyma.

The original form of the calicles is that delineated in fig. 16, being perfectly circular, with thin margin, without indentations as later acquired, fig. 11. There are twelve regular, equal, short septal laminæ with sharp, thin interior edge. At much regular distances (pl. XI, figs. 14, 17) short, thin spines go out from them, all directed downwards in a most characteristic manner, contrary to what obtains in all other Heliolitidæ. These spines (figs. 14, 15) are often incrusted with microscopic crystals of ferric oxide hydrate or manganous oxide hydrate which have occasioned some confusion in the descriptions by a few authors as if they were of organic origin. Such accumulations of crystals also occur in the coenenchymal tubes as seen in fig. 15. In some instances the septal spines are inclosed within a sheath of clear crystalline quartz all the way down, giving the spines in a transverse section a peculiar appearance.

The tabulæ are much distantiated, thin, oblique or horizontal. In the coenenchymal tubuli again (fig. 17) they are more frequent, even as many as four on the space between two of the calicular tabulæ. The narrow tubuli of the coenenchyma by and by expand or widen and are changed into real calicles, as SARDESON already has observed.[1] This is the same sort of coenenchymal gemmation which also occurs in Hel. hirsutus.

Several varieties of Chætetes and Monticulipora have sometimes been confounded with typical specimens of this coral, but they can be well distinguished upon closer examination. So the Heliolites dubius var. minima of FERD. ROEMER, as he named some specimens of a Monticulipora, distributed to foreign museums, but not described. It is to such that he alludes in the Lethæa geogn. I, p. 506, where he says that some specimens of Hel. dubius have maculæ quite as Monticulipora. But in reality such specimens are Monticuliporæ as I have assured myself through study of an original.

Proheliolites dubius is entirely restricted to the uppermost strata of the Lower Silurian formation. It is widely distributed in the Baltic provinces of Russia and dispersed in the diluvial beds of North Germany, where Sadewitz in Silesia is one of the most renowned localities. In Estland it occurs at Lyckholm, Kurküll, Worms, Pattuka near Worms and other places. In Sweden it has been found at Boda, Osmundsberg, Skatungbyn, Lissberget and Östbjörka, all in Dalecarlia in the stratum which the Swedish geologists have named »Leptæna Limestone», corresponding to the Lyckholm and Borkholm strata of Estland. It has also been found loose in a morainic accumulation on Gotland at Öjle myr, from where Dr C. WIMAN has dissolved out from the blocks by means of acids a large collection of fossils probably belonging to a passage bed between the Lower and Upper Silurian, older than the Arachnophyllum stratum on the coast near Wisby. The strata, of which these blocks are fragments, have not as yet been found *in situ*. The specimen delineated on pl. XI, figs. 16—17 has been kindly communicated by Dr WIMAN from the Öjle myr.

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[1] Tabulaten, p. 272.

Tribus II. **Plasmoporinæ.**

The most prominent, distinguishing feature of the genera composing this tribus is the constitution of their coenenchyma, almost entirely made up of thin, convex, minute lamellæ, which, superimposed upon each other, form a vesicular tissue. As may be induced from the coenenchyma of a few Plasmoporæ (Plasm. stella, Pl. scala, pl. v, f. 21, 28) where the Heliolitic type of coenenchyma is coordinate with the vesiculous, the convex lamellæ are undoubtedly homologous with the regular horizontal tabulæ in the coenenchyma of the genus Heliolites or, as it were, the convex lamellæ are convertible into horizontal tabulæ and *vice versa*. Another characteristic of the Plasmoporinæ consists in the presence of unconnected rods, slender rods (*bacilli*) or thick rods (*baculi*), standing errect or vertical in the midst of the vesicular tissue (pl. VII, f. 13, pl. x, f. 9, 18) as already has been mentioned above at pages 11, 12. To these may also be numbered the frequent, vertical aculæ which have grown on the convex lamellæ, either dispersed without order amidst these or being disposed in several coordinate or juxtaposite longitudinal rows (pl. VII, fig. 10), though without any connection with each other, but, as it were, foreshadowing the long, vertical bacillæ, which united alongside which each other, at last formed coenenchymal tubuli.

The septa have spiny margins or their laminæ are entirely dissolved into rows of spines, which are directed in the same way as the elementary fibrillæ, of which they in reality are compounds. The calicinal tabulæ are generally horizontal or concave as in the genus Heliolites.

The modes of reproduction are also identical.

Before giving a description of the genera composing this tribe it may be convenient to review the characters given by MILNE EDWARDS and HAIME to the three genera which they considered as most nearly allied and which also by later authors have been grouped together.

The following table gives a survey of the characters upon which the said authors based their new genera.

The characters which are stated to be peculiar to each genus are printed in italics.

Plasmopora.	Propora.	Lyellia.
1849. *Comptes Rendus*, tome XXIX, p. 262.		
Polypier libre, subhémisphérique, à plateau commun recouvert d'une épithèque plissée concentriquement. Cloisons *rudimentaires*. Planchers horisontaux. Murailles minces. Calices à bords *non saillants*. Les polypiérites sont unies par d'assez grandes lames verticales radiées, entre lesquelles s'étendent d'autres lames horizontales.	Diffère du genre précédant par des calices à *bords saillants*, des cloisons *plus développées* et qui se prolongent extérieurement sous forme de petites côtes.	

Plasmopora.	Propora.	Lyellia.
1850. *British Fossil Corals*, p. *lix.*		
Calices *immersed.* Septa *rudimentary.*	Calices with *exsert* margins. Septa *more developed*, extending outwards as to constitute small costæ.	
Walls thin. Coenenchyma of large vertical, radiate laminæ united by smaller horizontal plates.		
1851. *Polypiers terrains paléozoiques*, p. 221 and the following.		
Polypier massif. Calices circulaires *non saillants.*	Polypier massif. Calices circulaires à *bords un peu* saillants.	Polypier massif.
Murailles *minces* mais bien distinctes.		Murailles *épaisses* et *costulées.*
Coenenchyme, *grandes lames verticales radiées representant côtes et unies par des traverses à peu près horizontales.*	Coenenchyme . . . une exothèque à cellules *inégales et assez irrégulières, mais dans laquelle les côtes ne se prolongent que peu ou point.*	Périthèque vésiculeuse et très abondante.
Douze cloisons bien développées en largeur.	Douze cloisons assez étendues en largeur et qui se continuent extérieurement sous forme de rayons costaux.	Cloisons bien développées.
Planchers *sensiblement* horizontaux. Se distingue des autres par le grand développement de l'appareil costal.	Planchers horizontaux ou un peu irréguliers.	Planchers un peu irreguliers.
1860. *Histoire naturelle des Coralliaires*, vol. III, p. 241.		
(Description exactly identical with that of 1851, excepting »cloisons bien développées en *longueur*» instead of »largeur», possibly through misprint.)	Calices circulaires à bords saillants. Coenenchyme médiocrement développé et constitué par des traverses nombreuses et subramifiées. Cloisons bien développées et s'étendant en dehors de façon à constituer de petites côtes.	Coenenchyme très développé entièrement vésiculeux rappellant tout à fait la périthèque des Galaxées.

If we now scrutinize the above given characteristics we shall find that in the earliest descriptions, of 1849 and 1850, there are some essential differences, which later in 1851 and 1860 are effaced, so as to make the distinctions not perceptible. So, for instance, it is at first said that in Plasmopora the septa are rudimentary and in Propora again more developed. In 1851 and 1860 it is said concerning both these genera that they

have »cloisons bien développées», and so forth. As to Lyellia there is only said that its »murailles» are »épaisses et costulées», in all other respects it coincides with Propora and scarcely not in that respect, as it is also stated that Propora has costæ. For the rest there are further down under the genus Camptolithus reasons adduced for not longer retain Lyellia as an independant genus. I think, that if there were no other differences found between Propora and Plasmopora than those adduced by MILNE EDWARDS and HAIME, there is no great cause to keep them apart and this was also the reason why I formerly united both under Plasmopora. But through later researches I have seen that there are actually differences of generic value. As to Plasmopora and Propora, having many features in common, there are still several points which are of value as distinction, thus for instance, that in Plasmopora there are in the coenenchyma large vertical laminæ. In Propora there is strictly only Propora tubulata with exsert calicles or with »bords saillants» and in Plasmopora also some species are provided with exsert calicular margins. There are Plasmoporæ, some with long and others with nearly rudimentary septa, but the generic distinction does not depend on this circumstance alone.

The characters of the Plasmoporine genera, according to my conception, are the following.

Gen. 1. *Plasmopora.* M. EDW. & HAIME.

Calicles surrounded by a stelliform space, formed by the continuation of the septa outside the theca and their union at the ends forming an area, called *aureola.* Coenenchyma of irregular, disconnected and interrupted tubuli, often changing into detached bacilli or even aculæ. The traverses are horizontal dissepiments as well as irregular convex laminæ, both sorts occuring in the same specimen.

Gen. 2. *Propora.* M. EDW. & HAIME.

Calicles without costæ or only very short ones, not forming an aureola. Septa consisting only of free spines not forming any lamellæ.

Coenenchyma entirely consisting of vesicular tissue without tubuli, with unconnected bacilli, baculi and aculæ.

Gen. 3. *Camptolithus* n. gen.

Tabulæ of the calicle convex, commonly short and intermingled as to form a vesicular tissue of small convex lamellæ, quite identical with that of the coenenchyma and also provided with aculæ and bacilli.

Gen. 4. *Diploëpora.* QUENSTEDT.

Calicles of varying shape according to their stage of development, with rows of spines instead of septal laminæ.

Coenenchyma of two different strata: the older and innermost vesicular, the younger and exterior of closely packed, straight baculi of a peculiar conformation.

I may here remark that SARDESON in his paper on the Tabulate Corals, p. 353, has established a Family of Plasmoporidæ in the Suborder Helioporidæ and includes in it, besides the two first above mentioned genera, also Pinacopora and Houghtonia. As to Houghtonia it is synonymous and identical with Columnopora, which latter was ranged by SARDESON with Michelinia as member of his new family Pleurodictyidæ, but both are synonyms and identical with Calapœcia, an older genus of BILLINGS, which according to the views I have represented above at page 24 has no connection with the Heliolitidæ. As to Pinacopora I cannot find it different from Propora, and it is probably only a variety of the common species Pr. conferta.

Plasmopora. MILNE EDWARDS & HAIME.

1839. Porites p. p. LONSDALE. Sil. Syst., p. 687.
1849. Plasmopora MILNE EDW. & H. Comptes Rendus, tome XXIX, p. 262.
1850. Astræopora D'ORBIGNY. Prodr. I, p. 50.
1851. Palæopora MAC COY. Brit. Palæoz. Foss., p. 17.

I some time, adhering too closely to the distinctive characters given by MILNE EDWARDS and HAIME in their fundamental works, held the opinion that the corals belonging to the genera Propora and Plasmopora could not be generically kept apart, but must be joined in a common genus, Plasmopora, to be retained as being the oldest. But since I have been able to examine a richer material of specimens I have found that both genera are very well distinguished from each other.

Plasmopora is well separated from all other genera by the following peculiarity. The calicle proper is surrounded by a more or less stelliform space or area, formed by the twelve prolongations of the septa which stretch outside the theca of the calicle and enclose longitudinal compartments and unite with each other through a curved lamina at the ends. This distinctive area, which is found in all species of this genus, I have called an *aureola*. A good specimen of it is to be seen on plate XI, fig. 36 and others. If the calicles are closely set, the aureola cannot expand as much as else and those of neighbouring calicles intermingle.

The septa are either coherent lamellæ of fibrous texture with spiny margins or, as it were, broken up, nearly entirely, in oblique, strong spines. The coenenchyma has irregular tubes, they are crooked and bent, their walls are discontinuous or the traverses mingle from different tubes. The traverses can be regularly horizontal, funnelshaped or obliquely intercrossing and besides in the same specimen the convex lamellæ can exist alongside with the former. The aculæ are present together with bacilli and it can actually be observed (pl. VII, fig. 10), how the latter have been formed out of the former. Coenenchymal gemmation has been observed in two species. From the septa and the aureolar radii being simple or barbed, from the different internal structure specific characters may be obtained.

This genus is at the earliest found in the lowest Upper Silurian beds continuing prolific in variable forms through the whole of that formation, but not higher, so that not a single specimen is known from the Devonian formation.[1]

In distinguishing and describing the species belonging to this genus or rather in trying to subdivide the various fossil forms pertaining to it, into distinct species great difficulties are to be encountered through their great variability and their similarity in many features. There are at least three groups of species. One contains Pl. petaliformis, foroensis, calyculata and scita with their large spiny septa, the sinuous barbed aureolar radii, the irreguliar coenenchymal tubuli, with spiny walls, and the coenenchyma composed both of convex lamellæ and aculæ, bacilli or irregular tubuli enclosing vesicular lengthened traverses. Another group is formed by Plasmopora suprema, rudis and heliolitoides with short, nearly evanescent septa, a narrow aureola, and peculiar funnelshaped and oblique traverses in the irregular tubuli. A third group consists of Plasmopora stella, scala and rosa with large, well developed aureola, simple straight septa and partly with nearly regular Heliolitidean coenenchyma. To these I have joined yet one species, the belonging of which to this genus may be contended, but I can at present not find it in greater affinity with any other genus.

The geological distribution of these species is the following:

	Upper-most strata of Lower Silur.	Arachno-phyllum strat.	Llandovery.	Wenlock shale.	Wenlock limestone.	Ludlow beds.			
		a	b	c	d	e	f	g	h
Plasmopora petaliformis Lonsd.				*	*		*		
foroensis n.							*	*	*
calyculata n.			*	*	*				
var. tuberosa n.					*				
scita M. Edw. & H.			*	*	*				
follis M. Edw. & H.					*				
stella n.		*							
scala n.		*							
rosa n							*		
suprema n.								*	*
rudis n.								*	*
heliolitoides n.				*					
? reticulata n.		*							

[1] On the pretended Devonian species see at the end of this genus.

Plasmopora petaliformis. LONSDALE.

Pl. VI, figs. 1—12.

1839. Porites petalliformis LONSDALE. Sil. Syst. II, p. 687, pl. 16, figs. 4, 4*a*.
1849. Plasmopora petaliformis EDW. & H. Comptes Rendus, vol. XXIX, p. 262.
1850. » » IID. Br. Foss. Cor. Introd., p. *lix*.
1851. Palæopora petalliformis M'COY. Brit. Palæoz. Foss., p. 17.
1851. Plasmopora petaliformis EDW. & H. Pol. pal., p. 221.
1854. » » IID. Brit. Sil. Cor., p. 253, pl. LIX, figs. 1, 1*a*, not fig. 1*b* which belongs to the new species Plasmop. stella.
1860. » » IID. Hist. Nat. Cor. III, p. 240.
? 1862. Porites petalliformis M'COY. Sil. Foss. Ireland, p. 62, uncertain whether identical.
1867. Plasmopora petaliformis LINDSTR. Nom. Foss. Gotl., p. 27.
1867. » (Heliolites) » DUNCAN. Siluria, pl. 39, f. 4.
1879. » » QUENSTEDT. Petref. Deutschlands, p. 152, Taf. 149, f. 11.
1880. » » NICHOLSON & ETHERIDGE. Girvan, p. 267, Fig. *A*, but not in »Tabulate Corals», pl. XI, f. 5 and pl. XII, f. 1, which differ in having no septa.
1883. » » FERD. ROEMER. Leth. Geogn., p. 510, fig. 121 *a—b*. The last figure is in so far inexact that the septal spines are not delineated.
1883. » » VON KOCH. Palæontogr., p. 334, pl. 43, figs. 12—15.
1885. » » LINDSTR. List. Foss. of Gotland, p. 18.
1888. » » ID. List. U. Sil. Foss. Sweden, p. 21.

The English specimens have grown in regularly semiglobular disks of circular circumference, with the superior surface convex, hollow or flattened on the basal side, which is concentrically, coarsely wrinkled by a thin epitheca. The Gotlandic specimens are more irregular, forming larger disks of moderate thickness.

The *calicles* have a diameter varying between two and one millimeter according to the specimens. The edge is rather oftener exsert than immersed.

The *septa* are variable in length (fig. 7), though usually long (fig. 10) and straight. In sections (figs. 1, 4) they are often destroyed and shortened. They have no large lamina (figs. 9, 12 etc.), are divided into spines, more or less curved, which do not reach to the centre of the calicle. The *tabulæ* are sparse, thin irregularly concave.

The *aureola* surrounding the calicle is of varying width, with radii as long as the diameter of the calicle or even only as half that size. The radii may be crooked or straight, often with barbs on both sides. The compartments between the radii are of the same width near the theca as at their outward edge, only a little widening. The coenenchymal tubes are much irregular, especially as to their size, and upon the whole they are rather scarce, as the space between the calicles is chiefly occupied by the aureolæ. It is difficult to find how this vertical part of the corallian sceleton is placed in relation to the vesicular tissue of the coenenchyma. There are aculæ, ordinate in longitudinal rows (figs. 5, 9), these have coalesced (fig. 12 at the right in the coenenchyma), forming two zigzaglines enclosing modified bladders, becoming nearly square or flattopped instead

of convex. Of this latter structure the section fig. 11 is almost entirely composed. In the English specimen, fig. 3, being the lowest part of the same as in figs. 1 & 2, the coenenchyma is nearly free from all vertical elements and composed of large, very convex laminæ. I suppose that the shaded portions of the coenenchyma, fig. 12, vertically streaked, are derived from the walls of the aureola or of the tubuli, occasionally sectioned in a parallel direction or alongside. The dark patches again seen in the transverse sections (fig. 1) and others are due to the convex laminæ.

As a variety of this species I regard a coral from Tjelders in Boge delineated pl. VI, figs. 13—15. The aureola is more richly developed with thick, branching radii, covered with larger and more numerous barbs, quite as long as the diameters of the calicle, the septa are nearly of the same conformation as in the former, the coenenchyma of the cancellate fashion which is so predominant in Plasm. follis. It cannot be denied that there exists a wide range of differentiation in this species, when for instance the section fig. 8 is compared with fig. 1 or fig. 10. The septa which are so long in fig. 10 have evidently been destroyed in figs. 1 & 8. The abundant spinosity in the coenenchyma of the latter may in some measure be dependent on its mode of growth, which is somewhat irregular, a great obliquity discernible. As to the great differences in the coenenchyma there are evident transitions from the solely vesicular structure in fig. 3, to that of figs. 5 & 9 with aculæ, from that to the more developed quasi tubular or cancellate in figs. 2 & 11. This species occurs not rarely at Dudley in England in the Wenlock limestone, more seldom in the strata of Gotland corresponding to the Wenlock shale of England, at the islet Stora Carlsö, and also in the limestone of Simunde, Bara belonging to the stratum *f.* of Gotland. DE KONINCK in »Recherches sur les fossiles paléozoiques de la nouvelle Galles du Sud», p. 24, also cites this species as occurring there, but as I have not seen his specimens I do not feel sure of the identity, the more so as his description is very incomplete.

Plasmopora foroensis n.

Pl. VI, figs. 16—22, Pl. VII, fig. 1, sections I—IV.

Corallum disciform or tuberose or grown in irregular, rounded lumps.

Calicles in diameter 2 millim. at the highest, with thick, exsert edge, a little angularly folded in face of the *septa*. These are of unequal size, long ones reaching near the centre, mixed with much shorter, but without the alternation, so evident in Heliolites porosus. The centre of the calicle is occupied by the superior ends of lower lying septal spines, which in a section project as some irregular dots (fig. 18). They form no laminæ, but are dissolved into large, closely placed, upwards curved spines (see especially fig. 21). The *tabulæ* are extremely fine or thin, horizontal or wavy and slightly concave. The *aureola* is well discernible, though much entangled with excrescences, but attains only half the width of the calicle. As the calicles lie close, there is not much space for other coenenchyma and even the aureolas become mixed up with each other. In a longitudinal section the cancellate structure predominates. The concave laminæ are enclosed between

the zigzagshaped walls of the tubuli and have a peculiar appearance, placed obliquely above each other f. 22.

Coenenchymal gemmation has been observed in this species as represented in pl. VII, figs. 1, I—IV. It begins from the walls of the tubuli between two aureolas, which are dissolved (II) in a number of aculæ, surrounded by an irregular girdle, the first vestige of the future theca. This (in III) gains more regularity and the bases of the septa are visible at several points, while the scattered aculæ in the middle show their tops, which at last (IV) are arranged in regular series, the final shape being nearly attained. This species comes near to the former, but is well distinguished from it through its coarser and thicker vertical elements, through the larger and more dense septal spines and through the entirely cancellate coenenchyma with its peculiar intercrossing lamellæ.

It has been found only in Gotland where it occurs plentifully in the uppermost limestone beds, *f*—*h*, at the following localities. In the isle of Fårö, from which the name of the species is taken, at Ryssnäs and Dember, at Kylley, Othem, Slite on Lotsbacken, Lännaberget and Enholmen, Tjelders in Boge, Bara backe, Simunde in Bara, Hörsne, Follingbo, Wisby, Myrsjö kanal in Stenkumla, Klinteberg.

Plasmopora calyculata. LINDSTRÖM.

Pl. VI, figs. 23—30.

1883. Plasmopora calyculata LINDSTR. in RICHTHOFEN's China, Bd 4, p. 59, Taf. VII, figs. 8—9.

Corallum grown in semiglobular masses with flat base wrinkled by a thin epitheca.

The *calicles* lie in the midst of the bottom of shallow pits, which are well circumscribed by a polygonal (commonly pentagonal), ridge. (Pl. VI, fig. 23.) Each such well defined cup varies between five and seven millimeters in diameter. The calicle proper in the midst of it attains 2 millims. This interesting feature of clearly divided areas around the small calicles, more evident in this species than in any other, has given the first impulsion to the interpretation of the nature of the coenenchyma which I have tried to express above (at p. 14, 18). According to this view I consider each such polygonal area as the whole of a calicle proper *per se*, consisting of the interior area with the septa, commonly called the calicle, surrounded by the interior theca and outside this the exterior area or border, commonly called coenenchyma, only separated from the adjacent calicles through the dividing ridge, without any exterior theca or epitheca. The same characters have been found in other Heliolitidæ as stated, through not so pronounced as in this species. What of the coenenchyma in the plurality of the species of this group is confluent and not interrupted or marked out by confines and thus forming a common structure for the whole polypary, is in this species portioned of to each individual polyp and thus indicating the signification of its nature. The theca is exsert and raised above the aureola, and in one pieee with the septa. The *septa* are well developed, straight and reach nearly to the centre. The theca forms obtuse angles in face of the septa. They consist of a

coherent lamina fringed in the edge by short, fine spines figs. 28—30. Their composition of minute, upwards directed fibrillæ is evident. The *tabulæ* are thin and irregular, as if bent and broken, and much distantiated.

The *aureola* is well developed, the compartments short and broad; the radii richly provided with lateral thorns and barbs. The width of the aureola corresponds to the moiety of the calicle. Outside the aureola there is an abundant *coenenchyma* far more so than in the preceding species where the calicles are more close. Seen on the surface of the coral it is a network af rounded, irregular meshes with funnelshaped bottoms. A little below the surface (fig. 26) almost the same appearance prevails. Deeper down (fig. 27) there is a change and the radii of the aureola are simpler, without lateral barbs, the coenenchyma more regular. In the longitudinal sections the vesicular structure is prevalent, the convex lamellæ are of much unequal size and there are only a few aculæ scattered without order amongst them. Some darker patches may indicate fragments of the vertical elements. A few vestiges point to a cancellate arrangement.

The fig. 25 represents a specimen of coenenchymal gemmation. The incipient theca enclosing eight or nine rudiments of septa is visible. This interesting species has been found only in the lowest shale beds *b* and *c* near Wisby and its neighbourhood, Skälsö, and as far north as Halls huk, in south to Gnisvärd, Eskelhem, Djupvik in Eksta, Stora Carlsö and Sproge. Abroad the only known locality, Dudley in England, has contributed with a few specimens, which probably belong to a higher stratum than in Gotland or to the Wenlock limestone.

Plasmopora calyculata var. *tuberosa* n.

Pl. VII, figs. 2—5.

The corallum forms irregular tubers of variable shape, covered all around with calicles. These are sometimes a little more than 2 millimeters in diameter. The *wall* is exsert and composed by the thick exterior ends of the septa. Instead of the ingoing angle formed at the exterior septal end at the other species, this angle is here completely filled with calcareous matter in the shape of a transverse rhomboid, giving in combination with the annexed often straight septum the aspect of a little nail. The *septa* are simple or also provided with lateral barbs and hooks. They consist of a coherent lamella with edges fringed by small spines and reaching far towards the centre of the calicle. The *tabulæ* are irregular and much scarce.

The *aureola* is present, but much irregular and difficult to decipher. In a transverse section it is more evident, its compartments of unequal size, no doubt depending on their having grown on inclined planes. The *coenenchyma* is abundant and well composed of tubes of variable size and shape. In a longitudinal section these are not so well discernible as the large traverses of convex lamellæ.

Of coenenchymal gemmation there are several instances from beginning alterations of the coenenchyma to different stages of the rudimentary theca and septa.

This pretty coral has chiefly been found in numerous specimens in the limestone stratum *d*. of the Wisby region. There are also specimens from Alnäse and Ryssnäs in Fårö which belong to this species.

The most characteristic feature lies in the formation of the theca and its nailshaped septa, and also in the structure of the exuberant coenenchyma. In a few specimens there are also slight vestiges of shallow pits round the calicles.

Plasmopora scita. Milne Edwards & Haime.

Pl. VII, figs. 6—18, pl. VIII, figs. 1—3.

1851. Plasmopora scita M. Edw. & H. Pol. pal., p. 222.
1854. » » Id. Brit. Sil. Cor., p. 254, pl. LIX, figs. 2, 2*a*.
1860. » » » H. N. Cor. III, p. 240.
1867. » » Ldm. Nom. Foss. Gotl., p. 27.
1879. » » Quenst. Petref. Deutschl. I, p. 145, pl. 148, fig. 32, *o*, *x*, excl. *u* & *y*.
1880. » » Nicholson & Etheridge. Girvan, p. 267, figs. *B*, *C*.
1880. Plasmopora exserta Id. Ibid., p. 269, pl. XVII, figs. 4, 4*a*.
1883. Plasmopora scita Ferd. Roem. Lethæa Geogn., p. 511, fig. 121*c*.
1885. » » Lindstr. List of Foss. Gotl., p. 18.
1888. » » Id. List of Upp. Sil. Foss. Sweden, p. 21.

This, perhaps the most common of all our Plasmoporæ, assumes as may be beforehand immagined, a great variety of shapes. It is commonly disciform, having the caliciferous, superior surface flat or slightly gibbous, but there are also domeshaped colonies or globular and irregularly spheroidal and tuberose.

The calicles are the smallest in the whole genus and scarcely attain one millim. in diameter. As to their form they vary in the highest degree, especially those from the stratum *d* near Wisby, and there might be justified doubts entertained that such extreme forms as those on pl. VII, fig. 6 and fig. 16 could belong to the same species or even to the same genus, were not numerous transitions found between them, even on the same polypary.

The common form is represented in fig. 6, where the calicles are most regular and the theca entire, its edge a little exsert and tuberculate where the septa continue through it as radii of the aureola. Now it happened that the theca has been, as it were, broken up in twelve disconnected small pieces (pl. VIII, fig. 1) formed by the nodules where the septa cross the theca and continue in the aureola. They become more and more flattened, pl. VIII, f. 2, 3, the boundary line between calicle and aureola vanishes and the broad, flat septa covered with innumerable warts or aculæ are confluent with the coenenchyma, of the tubuli of which only a few indistinctly circumscribed pits remain (fig. 16). That this variety of calicle really belongs to this species is clearly demonstrated by the transverse section (fig. 17) taken a little below the surface, in which the characters of Plasmopora return, to be compared with the other sections (figs. 7, 9, 12, 14, 15), only that in fig. 17 the coenenchyma is a little thicker. As represented in figs. 14 and 15 there is also great difference in the proximity of the calicles.

The *septa* are not lamellar, they consist of a dense row of large, closely packed spines (fig. 18), which reach to the centre and nearly obscure the thin, much distantiated tabulæ. The granulated septa, as seen in the bottom of the superficial calicles, f. 16, represent the bases of the spines, which later grow out from these. In a section from the older portions of a polypary (fig. 11) there are also small aculæ on the superior surface of the tabulæ, no septal spines in the lowest parts and rather scarce in the beginning. But there is no telling whether this is the original structure or rather a condition due to inorganic changes during the fossilization.

The *aureola* is distinct and regular in the typical specimens (as fig. 6). Owing to the proximity of the calicles there is not much space left for other coenenchymal tubes. The *coenenchyma* in a longitudinal section is chiefly vesicular, the convex lamellæ of greatly different size. There are longitudinal rows of aculæ which also combine into rods and constitute irregular tubuli (fig. 18) enclosing traverses.

There are indications of coenenchymal gemmation (fig. 10), as well as of a calicinal one, in small colonies rising out from the surface of older calicles.

This species has been frequently found in the older strata of Gotland. It does not occur deeper than in the marly beds of *b* and not higher than in the Wenlock limestone (*d*) of Gotland. It has been found in the following localities. Ryssnäs in Fårö, Hall, Halls huk, Follingbo, Dalhem, Wisby (*b*, *c* & *d*), Walveref, Blåhäll in Tofta, Nyrefs udde in Tofta, Gnisvärd, Westergarn, on the shore south of Westergarn, Eskelhem, Ekska, Lilla Carlsö, Stora Carlsö, Hoburg.

Out of Gotland it is said also to occur in the Upper Silurian of England, from where I have not seen specimens.

Specimens sent to me from the late Prof. JAMES HALL of Albany, under the denomination Heliolites spinipora from Lockport, N. York seems to belong to this species, not to Propora as M. EDW. & HAIME, H. N. Cor. III, p. 242 have stated.

Plasmopora follis. EDW. & H.

Pl. VII, figs. 19—20.

1850. Plasmopora follis EDW. & H. Pol. palæoz., p. 223, pl. 16, figs. 3, 3*a*.
1860. » » FERD. ROEMER. Tennessee, p. 24, Taf. II, figs. 6, 6*a*.
1860. » » EDW. & H. H. Nat. Cor., III, p. 240.
1876. » » ROMINGER. Michigan, p. 14, pl. III, fig. 2.
1879. » » QUENSTEDT. Petref. Deutschl., p. 147, pl. 149, fig. 1*a*—*c*[1].
1883. » » FERD. ROEMER. Lethæa Geogn., p. 511.
1885. » » DAVIS. Kentucky Fossil Cor., pl. I, fig. 9 (f. 10 too indistinct.).

It grows as a rounded, irregularly spherical corallum.[1]

The calicles are circular not at all exsert, not much more than one millim. in diameter.

[1] The specific name has been derived from the latin *follis*, signifying a pouch or a rounded sack.

The *septa* are of the shortest, scarcely visible in a longitudinal section as small aculæ, which also sit on the very regular tabulæ. The *aureola* is distinct and regular attaining $^3/_4$ of the diameter of the calicles, those of neighbouring calicles being intermingled. The coenenchyma is of the cancellate order, the tubuli with angular or zigzagformed walls, giving in combination with the traverses a polyedric appearance to the compartments of which it is composed, fig. 20. There are also dark patches, probably vestiges of the tubular walls.

This is an exclusively American species. The Swedish State Museum possesses specimens of it from Tennessee, Decatur C^ty^, a gift from Prof. FERD. ROEMER, from Perryville, Cincinnati, and Louisville, Kentucky, a gift from Dr W. R. HEAD in Chicago.

It differs from the other species through its short septal spines and the minute aculæ on the tabulæ, and through its regularly cancellate coenenchyma.

Plasmopora stella n.

Pl. V, figs. 19—26, 29, sections I—VII, pl. XI, figs. 36, 37.

1854. Plasmopora petaliformis M. EDW. & H. p. p. Brit. Foss. Cor., pl. LIX, fig. 1*b*, not the others; this is delineated from a different specimen than the other figures, which represent the true Plasmop. petaliformis.

Corallum discoid, flat on the superior surface, as well as on the inferior one with its thin, finely wrinkled epitheca.

The *calicles* of little more than 1 millim. in diameter, have rather long septa, consisting of large, coherent lamellæ, in the edges serrulate by irregular, upwards directed spines, the lamellæ being striated in the same direction. The *tabulæ* are concave, irregular, intercrossing and being secreted later than the septa at the same height they are intersected by these and reposing between them.

The *aureola* is one of the most regular and typic. (Especially pl. XI, fig. 36.) Its width is equal to $^3/_4$ of the diameter of the calicle. The twelve compartments formed by the prolongations of the septa are equalsized, wedgeshaped, a little widening outwards. In a longitudinal section this zone is distinctly separated from the other narrow coenenchymal tubuli as broader belts, one on each side of the calicular tube, pl. XI, f. 37.

On the outside of the theca, in some specimens (fig. 22) small costæ are to be seen between the radii of the aureola, without any connection with the interior of the calicle.

The *coenenchyma* outside the aureola consists of tubuli nearly like those of a Heliolites (fig. 23 and pl. XI, fig. 37) or also more irregular (figs. 20, 22, 25). They are transversally divided by regular, horizontal tabulæ which, however, sometimes, especially within the aureolar zone, are modified into convex lamellæ.

The coenenchymal gemmation has been observed as represented on pl. V, fig. 29, sections I—VII. Out of a highly irregular coenenchyma two new calicles are developed in such manner that the vertical walls of the tubuli by and by concentrated on two points become roughly circular (III) with some incipient septa (IV). In the left hand calicle (V)

there are vestiges of an aureola and 10—11 septa. In section VI the right hand calicle again is more advanced, with twelve septa and eleven rudimentary aureola compartments, also in section VII.

There exists moreover a sort of calicular gemmation, the calicles having grown upwards detached from the ambient coenenchyma, secreting a new coenenchyma around their thecal edge, from which buds grow in accordance with the procedure already described above in Heliolites.

To be remarked is the pitted surface of some specimens, forming small polygones, evidently marking out the boundaries of each single calicle with its interior area, commonly called calicle, in the centre and the coenenchymal border around it as in Pl. calyculata. There are transitions from quite smooth or plane surfaces to such with very shallow pits and at last those with deep ones.

In a few calicles abnormities have been found with only 8 or 10 septa, the only deviation known amongst the Heliolitidæ from the regular number of twelve.

This species has been found in several specimens on the shores near Wisby, evidently derived from the lowest Upper Silurian beds of Gotland, the Arachnophyllum stratum, *a*, and I have also a specimen from a nearly corresponding stratum G^1 at Kattentack in Estland. In Norway it occurs in the islet Malmökalven in the Christiania-fiord.

Plasmopora scala n.

Pl. V, figs. 27—28.

Corallum disciform, thickness at most 10 millims., with calicles only on one side. *Septa* reaching nearly to the centrum, equal, simple and straight, forming a coherent lamella with irregular spines in the edges. The *tabulæ* are concave, distantiated. The *aureola* is regular, in width nearly equal to the diameter of the calicle. Its radii are a little sinuous and provided with short lateral barbs.

The *coenenchyma* seen in a transverse section presents the many, small, irregularly polygone tubuli, the walls of which continue downwards, sinuous, interrupted, enclosing horizontal traverses. There are only few convex lamellæ besides.

The chief differences from Pl. stella lie in the structure of the aureolar radii, these being barbed, not smooth, and also in the irregularity of the coenenchymal tubuli.

It has been found only in the Arachnophyllum bed *a* near Wisby.

Plasmopora rosa n.

Pl. VII, figs. 21—23.

Corallum disciform. *Calicle* scarcely attaining one millim. in diameter, provided with twelve short *septa* reaching halfways to the centre, forming a narrow lamella fringed in the edge and composed in the usual manner by microscopic fibrillæ directed upwards. The *tabulæ* are horizontal or oblique and a little concave, closely set. The *aureola*

resembles that of Pl. stella, has regular, simple radii and in breadth it equals $^3/_4$ of the calicular diameter. The compartments widening outwards. Between the aureolas there is a rich coenenchyma of polyedric tubuli of unequal size, enclosing minute, convex lamellæ, which in each tubulus form two rows, the opposite through their oblique position dovetailing each other (fig. 23) and thus causing the appearance as if there were funnelshaped dissepiments. Besides there are also long zones of the common vesicular appearance.

This species belongs to the same group as Pl. suprema and Pl. rudis in consequence of its peculiar coenenchymal traverses, but differs from them through its well developed septa and the aureola which resembles that of Pl. stella.

It has been found in the uppermost limestone beds (*h*) of Linde klint in Gotland.

Plasmopora suprema n.

Pl. VII, figs. 24—26.

Corallum disciform, *calicles* small, scarcely one millim. in diameter, theca only a little exsert, the *septa* are short or rudimentary, as crenulations in the theca and consequently in a longitudinal section only observable as a narrow, black band with faintly fringed edges. The tabulæ are horizontal and much distantiated, leaving a space of somewhat more than one millimeter between themselves. The aureola is large, but irregular, its width equals the diameter of the calicle. Its radii, all regularly connected with the septa, are unequal in size, bent, with lateral processes, which even cross a compartment and join two radii. The other coenenchyma is abundant, consists of tubuli of different size, polygonal or rounded. They continue downwards, but are interrupted and enclose more convex lamellæ than horizontal traverses. There are also free spaces of vesicular structure.

This beautiful species has been found in the central Gotland hills of Linde and Löjsta in the uppermost limestone.

Plasmopora rudis n.

Pl. VII, figs. 27—31.

The corallum has grown in large rounded, irregular masses, showing, as usual with those from the upper limestone strata, few vestiges of an epitheca. As these strata generally give evidence of being shore or shallow water formations in which waterworn and rolled fossils have been embedded, it cannot be expected to find them so complete as those from the shale beds. The calicles are in the typical variety of the largest in this genus, attaining 2 millims. in diameter. Of *septa* there are only rudiments as broad rounded lists covered with innumerable minute warty protuberances

(fig. 31). In a longitudinal section of the calicular tube (fig. 30) therefore only a thick theca is seen, unless a septal list is sectioned, as in the same figure at left, where it is obliquely streaked with the elementary fibrillæ. The *tabulæ* are rather distantiated, horizontal or concave (fig. 28). The *aureola* is narrow, scarcely attaining a breadth equalling half the diameter of the calicle. Its compartments are short, irregular, intermingled with those of the other, close lying calicles. The *coenenchyma* as seen in a longitudinal section consists of narrow stripes between the calicles, chiefly the aureolar tubes, which enclose the same kind of oblique, dovetailing traverses as in Plasm. rosa.[1]

In the theca of the calicles, represented in fig. 29, there are some lacunæ, as of perforations. They are caused by fissures and attentive examination of other specimens cannot detect any vestiges of perforated walls.

The now described variety is derived from the uppermost limestone beds of the northern part of Gotland, from Rute, Helvi, Klints in Othem, Klinte in Boge, quarries between Slite and Bäl.

In the corresponding strata of south Gotland another variety (fig. 27—28) occurs of the same structure, only deviating in lesser proportions. It has been found in the limestone beds of Sandarfve kulle, Mallgårds klint, Linde klint, Hageby in Etelhem.

Plasmopora heliolitoides n.

Pl. VII, figs. 32—33.

Corallum disciform or tuberose. The calicles of 1,5 millim. in diameter have no elevated margin of the theca and this is very thin. Of *septa* there are only the merest vestiges, some calicles being perfectly smooth inside, others faintly fluted by longitudinal septal lists, the septa protruding in a transverse section as diminutive tubercles. The *tabulæ* are regular, numerous. The *aureola* is the narrowest in the genus, only equalling one fourth of the diameter of the calicle. Irregular as the compartments may be, unequal, more than double broader than long, they are well discernible and twelve, with the radii starting just opposite the septal rudiments. As the calicles are much remote from each other the coenenchyma is most abundant, consisting of unequal tubuli, which in a transverse section are polygonal, exactly resembling those of many true Heliolitæ, but in a longitudinal section (fig. 33) they are by far not so regular, their thecæ are sinuous and crooked, not parallel, and the dissepiment upon the whole horizontal, also oblique. The two calicular tubes in fig. 33 have like others in the same section, not figured, arisen from the coenenchyma through gemmation.

This species has been found in the stratum *d* of Östergarn, Gotland.

In consequence of its regular coenenchyma it could easily be confounded with Heliolites decipiens, if not on a closer inspection its aureola and its more irregular coenenchyma were observed.

[1] The section fig. 30 has beside the calicular tube, at the right hand, only fragments of other calicles, one at left lowest, which is bent in another direction. The feathery lines are fragments of calicular walls.

Plasmopora? reticulata n.

Pl. VII, figs. 34—36.

Corallum disciform. The *calicles* circular, 1,5 millim. without the least vestiges of septa, the narrow theca being only a little indented at the point, where the radii of the aureola meet it. The *tabulæ* are closely set and regularly horizontal. The *aureola* is distinct though very narrow, in width a third of the calicular diameter. Its twelve compartments are unequal, often broader than long, the abundant *coenenchyma* has seemingly regular polyedric tubes of greatest brevity, but these are in fact formed by the transversally sectioned coenenchymal lamellæ. The short aculæ have in great abundance grown upon the convex lamellæ of which the whole vesicular coenenchyma is composed. This species has been frequently found in the Arachnophyllum stratum *a* around Wisby. The longitudinal section fig. 36 also informs us, how an older set of calicles has been overgrown and destroyed by coenenchymal growth and how this has turned sideways above a lacuna, now filled with clay and formed new calicles which have budded up out of it.

In the transverse section fig. 35, on the right hand, the short tubuli lie alongside convex laminæ. It is with some doubt that I place this coral amongst the Plasmoporæ as its coenenchyma rather is more like that of the next genus.

Milne Edwards and Haime have described in Hist. Nat. Cor. III, p. 241 a species of Plasmopora, Pl. micropora, as appertaining to the Devonian formation of Eifel, and they have identified it with Astrea micropora Goldfuss (nomen nudum) in the Museum of Bonn. Professor Clemens Schlüter has been kind enough to inform me that this fossil is no Plasmopora, but a Devonian »Fistulipora», nearly allied to, if not identical with Schlüter's Fistulipora cyclostoma, »Anthozoën des Rheinischen Mitteldevons», p. 161, Tab. XI, f. 7—8. There is thus no Plasmopora found younger than those from the uppermost beds of the Upper Silurian.

Gen. *Propora* M. Edw. & H.

1838. Astræa p. p. Angelin, Museum Paleont. Scand.
1839. Porites p. p. Lonsdale, Murch., Sil. Syst., p. 687.
1844. Sarcinula Dale Owen, Rept. Iowa, Wisconsin etc., p. 76.
1849. Propora Edw. & H., Comptes Rendus, XXIX, p. 262.
1850. Astræopora p. p. d'Orb., Prodr., I, p. 50.
1851. Palæopora p. p. M'Coy, Palæoz. Foss., p. 18.
1851. Lyellia p. p. Edw. & H., Pol. palæoz., p. 150.
1852. Heliolites p. p. Hall, Billings etc.
1878. Pinacopora Etheridge & Nichols., Girvan, p. 52.
1885. Plasmopora Lindstr., Foss. Gotl., p. 18.

Calicles with exsert edges, the septa, entirely wanting in some species, never form coherent laminæ as in Plasmopora and consist of disconnected spines. The tabulæ are generally regular, horizontal, never concave as so common with Plasmopora. The coenenchyma is entirely vesicular with dispersed aculæ and baculi, which do not connect so as to form tubuli. There is consequently no aureola, so distinctive for Plasmopora and only in a few instances the septa continue outside the calicles.

The most prominent characteristics, by which M. Edwards and Haime designated this genus, were that the calicles are exsert, that the septa were more developed in this genus than in Plasmopora and that they are extended outwards so as to form costæ. The first diagnostic is valid for almost all species of this genus, but for the others certainly not. Already in the typical species, Pl. tubulata, calicles occur, even in the same specimen, with external costæ together with others quite devoid of such. Several species are without septa, and in those which have such, they are more rudimentary than in Plasmopora.

The geological distribution of the species in this genus is as follows.

	Lower Silurian.		Upper Silurian.								
	Leptæna limestone.		Basal beds.		Llandovery.	Wenlock shale.	Wenlock limestone.	Ludlow.			
	Lyckholm.	Borkholm.	Borenshult.	Arachnophyllum.							
	F^1	F^2	a	b	c	d	e	f	g	h
Propora tubulata E. H.		*	*		*	*				
euryacantha n.						*		*		
conferta E. H.	?	*	*		?	*	*			
var. minima n.			*							
cancellata n.		*								
speciosa Bill.			*			*		*		
compacta n.						*				
bacillifera n.	*	*								
? ambigua n.			*							

Amongst the Heliolitidæ this genus contains the oldest known species, which reach deepest down in the strata. Upon the whole, four out of the nine forms of the Proporæ are almost exclusively Lower Silurian or from the lowest U. Silurian and of the other only two ascend to the Ludlow strata of Gotland. Now it is interesting to see how the genus Plasmopora, the younger of these two, nearly related genera, which as far as I am aware is not represented in the Lower Silurian strata, is more developed, has perfect septa and a coenenchyma in which the tubulate structure begins to manifest itself and in some even nearly as completely in Heliolites. With the older geological age of Propora its more

rudimentary structure agrees. SARDESON has said[1] that »die Zertheilung der Mauern» (to wit in the coenenchyma) »ist bei Plasmopora-Propora trotz des höheren geologischen Alters bereits weiter fortgeschritten als bei Heliopora». And »bei Propora geht die Reduction der Wände am weitesten». He has thus clearly expressed his opinion that Propora is a genus in the act of regress from a former more complete state. I think the case is quite the opposite and that these oldest forms of all Heliolitidæ are in a state of progress. The aculæ, bacilli and baculi which have grown amongst the ever present vesicular tissue are the fundaments, out of which the tubuli in later times have been developed, as is so well seen in the Plasmoporæ, which are, as it were, intermediate between Propora and Heliolites. They are not remnants of already dissolved tubuli, on the contrary the rudiments out of which the tubuli are built up.

It is also remarkable that the youngest species of Propora, as P. tubulata, in certain respects come near to the Plasmoporæ, especially to Plasmop. scita and show a sort of precursory formation of aureola in its costæ.

The almost absolute defect of the coenenchyma or its scarcity in some of the specimens belonging to Prop. conferta (see pl. VIII, figs. 32, 34, 37 and pl. IX, figs. 31, 32), and also another species (pl. IX, figs. 33, 34), is a feature which leads to the assumption of still older twelve septate corals without any coenenchyma at all, from which the true Heliolitidæ may have descended.

Propora tubulata. LONSDALE.

Pl. VIII, figs. 4—22, 24, 25, 28—31.

1838. Astræa densistellata ANGELIN. Museum Palæontologicum Scandinavicum, N:o 11.
1839. Porites tubulata LONSDALE. Sil. Syst., p. 687, pl. 16, figs. 3, 3*a*—3*f*.
1850. Propora tubulata E. & H. Brit. Foss. Cor. Introd., p. *lix*.
1851. » » ID. Polyp. paléoz., p. 224.
1851. Palæopora tubulata M'COY. Brit. Palæoz. Foss., p. 18.
1851. Lyellia americana E. & H. Polyp. pal., p. 226, pl. 14, f. 3, 3*a*.
1854. Propora tubulata E. & H. Brit. Sil. Cor., p. 255, pl. 59, f. 3, 3*a*, 3*b*. The fig. 3*b* gives no true representation of the interior structure.
1858. » » FR. SCHMIDT p. p. Archiv, p. 226.
1860. » » E. & H. Hist. Nat. Cor. III, p. 241.
1860. Lyellia americana E. & H. Ibid. III, p. 243.
1867. Propora tubulata LINDSTR. Nomina Foss. Gotl., p. 27.
1867. Heliolites (Propora) tubulatus SALTER in MURCH. Siluria, pl. 39, figs. 3—3*f*.
1880. Plasmopora girvanensis NICH. & ETH. Girvan, p. 266, pl. XVII, fig. 2.
1882. Lyellia americana J. HALL. 11th Rept. Indiana, pl. XLVII, f. 5, p. 381.
1883. Propora tubulata F. ROEMER p. p. Lethæa Geogn. I, p. 512, fig. 122 *obs*. The figure and probably also the description are more consonant with Pr. conferta.
1883. Plasmopora tubulata LINDSTR. in RICHTHOFEN's China, Bd IV, p. 60.
1885. » » ID. List. Fossils Gotl., p. 18.
1888. » » ID. List. U. Sil. Faunas Sweden II p., p. 21.

[1] Tabulaten, p. 282.

1892. Propora tubulata LEBEDEFF. Obersil. Fauna des Timan, p. 14, pl. 1, fig. 4*a*—*b*—*c* (not fig. 3). It is not quite sure that this belongs to the said species, which cannot be decided by the imperfect figures and description.

1894. Plasmopora tubulata WEISSERMEL p. p. Korallen der Silurgeschiebe Ostpreussens . . ., p. 668.

1896. Propora tubulata SARDESON. Tabulaten, p. 278, figs. 15—17.

The oldest denomination of this species is that given by ANGELIN in 1838, but as it is only a name without description in a collection of fossils, it is more appropriate to keep that which has been so long in general use.

Besides the above given synonyms there are several which in consequence of too insufficient descriptions and figures must, until nearer notion be gained, remain doubtful. Such are *Propora tubulata* EICHWALD 1860, Leth. rossica, I, 1, p. 455 seems to be a Lower Silurian species. DE KONINCK, Fossiles palæoz. N. Galles du Sud, p. 23, gives only the name of this species. Also in F. ROEMER's Sadewitz, p. 22, Tab. IV, f. 3 where the figure 3 shows a coral much deviating from the typical by MILNE EDWARDS & HAIME. The same species in NICHOLSON, Tabulate Corals, pl. II, f. 3, 3*b* can not be identical, as it does not show any vestiges of septal spines. QUENSTEDT's figure in Petref. Deutschlands, pl. 149, f. 12 does not show the characters. MALAISE 1873 in Silurien du Centre de la Belgique, p. 107 also enumerates Propora tubulatus (!).

This common and as to its surface much variable coral opposes the greatest difficulties to the endeavours to fix the distinctions between it and the closely simulating Plasmopora scita. In both we find a great variability in respect to the shape of the calicles, in the Pl. scita impossibility for the aureola to develop when the calicles are densely crowded and again in the Propora no development of an aureola, even when there is space enough between the calicles for such a development. There are great chances of confounding both species with each other and it may thus happen that the one species is current in scientific papers under the name of the other. And indeed when studying a large number of specimens of both one is at a loss to decide to which species some belong. Moreover the interior structure, as studied in longitudinal sections, is often nearly the same. At last it may perhaps be found that both are linked together through a series of intermediate forms at the opposite ends of which stand what we now call Plasmopora scita and Propora tubulata. It cannot be denied that Plasmopora scita in spite of its aureola has an interior organisation which is more in concordance with that prevalent amongst the Proporæ. It may, however, be borne in mind that the tendency to construe tubuli is stronger in Pl. scita than in Propora. For the present it may be advisable to keep the extreme forms separate and at least temporarily describe both as distinct species.

The characters common to all varieties of this polymorphic species are the following. The margin of the calicular theca is exsert and free above the coenenchyma and the diameter of the calicles larger than in Plasmopora scita. There is no distinct aureola, even in those specimens where the calicles are remote. The coenenchymatous, vesicular tissue is more lax and composed of large bladders as in fig. 10, pl. VIII.

The typical surface, as represented by MILNE EDWARDS and HAIME in Brit. Foss. Corals, pl. 59, fig. 3*a* and of which I through the kindness of Prof. ALPHONSE MILNE EDWARDS have received a plaster cast, is figured anew on plate VIII, fig. 4 from an

English specimen. The characteristic costal radii are on these well expressed, but in the deviating specimen fig. 8 there are no vestiges of them and only shallow grooves radiate irregularly from the calicles. This specimen is also interesting because it shows the bladders of the coenenchyma, which else lie concealed beneath the surface and accessible only in sections. These convex lamellæ are completely covered by diminutive wartlets, the bases of the aculæ, which are so numerous in the interior on the convex lamellæ.

In the variety, fig. 11, there are not the faintest traces of the grooves and there is a nearly even coenenchyma covered with blunt warts. This and similar specimens constitute a variety by themselves, as the interior structure also is deviating (figs. 12, 13) with thick calicular thecæ, longer and larger septal spines, the aculæ also thicker than else. These varieties have grown in ovate, sphæroidal or irregularly globular masses and consequently no epitheca is seen. The calicles are deep and the rim is composed of twelve noduli, exactly corresponding to the exterior end of a septum, fig. 11. In fact, these noduli are the bases of a new or the youngest series of septal spines which through the growth of the corallum become placed more and more deep in the calicular cup, at the same time extending in length and resembling the older ones. The tabulæ are thin, much distantiated, horizontal, sometimes with aculæ on their upper side. Such species as these are derived from the strata *d* of Gotland coëval with the Wenlock limestone of England. From far deeper strata, those of Borkholm, F^2, we have specimens which may be considered as the oldest of this species. They are diskshaped or slightly domeshaped, the calicles are more widely apart than in the younger, the coenenchyma nearly as in the variety fig. 11. (Figs. 18, 21, 22.) The septa are short, and broad, and reach only a little distance from the calicular theca (fig. 18). The coenenchyma is composed by uncommonly small, convex lamellæ and the aculæ are thick and broad (fig. 19).

I have ventured to join with these forms some which have for a long time been considered as belonging to the nearly related genus Lyellia. I have treated more in full further down about this genus and there given my reasons why I consider that it cannot be retained, as the species enclosed within it, partly cannot be distinguished from Propora, and partly must form a new genus. The two species which I consider as belonging to Propora and hardly to be separated from Pr. tubulata, are Lyellia americana (pl. VIII, figs. 24 and 25), and Lyellia parvituba (figs. 29—31). It is to be borne in mind that the specimens which I have seen, especially the former from Point Detour, Michigan, have been much altered through being silicified. Still they retain the characteristic features of their organization. In Lyellia americana the septa are larger, but resemble those in the English specimen of Pr. tubulata (fig. 5). In Lyellia parvituba (fig. 30) the septa again are shorter, but resemble those in figs. 15 and 16. The coenenchyma of both coincides as nearly as possible with that in fig. 10. The aculæ are in Lyellia americana (fig. 25) much enlarged through later additions and in Lyellia parvituba (fig. 31) they are still so in a much higher degree and the calicular tubes are partially filled by an exuberant crystalline growth of later date. There is a third species, Lyellia glabra EDW. & H., of which I have not seen specimens but which, to judge by the figures[1], perhaps also belongs to Propora.

[1] Pol. terr. palæozoiques, pl. 12, figs. 2—2*c*. Heliolites macrostylus QUENSTEDT, Petref.-Kunde, tab. 149, f. 5, 6 is evidently identic with this species. He has also given a good figure (tab. 149, f. 9) of L. parvituba.

It must, however, be remarked, that the figure of L. americana in the cited work shows peculiar reticulations of the surface, some of them resembling aureolas. In the photographic figures in ROMINGER's work[1] representing Lyellia americana there are no aureolas, rather the same sort of costal radii starting from the calicle as in the typical Propora tubulata. The only difference I at present can find between these American Lyellias and our Propora tubulata is the greater distance between the calicles of the former, though not larger than in the oldest above described varieties of P. tubulata. In my specimens of the American Lyellias I have not been able to detect aureolas and L. parvituba certainly has the calicles on an unaltered surface of a decided resemblance with Pr. tubulata.

The oldest variety of Pr. tubulata has been found in the uppermost Lower Silurian beds F^2 at Borkholm in Estonia and in the lowest Upper Silurian beds of Gotland *a*, the Arachnophyllum bed, near Wisby.

The typical variety occurs chiefly in the stratum *d* (Wenlock limestone) in the Wisby region from Westergarns holme in south to Hall, at Nyrefs udd in Tofta, Gnisvärd, around Wisby in the cliffs, Lummelunds kanal, and also at Eksta, Djupvik and higher in the limestone between Stjernarfve and Lefvede and south of Westergarn.

Abroad it occurs at Wenlock in England, at Undwa in Oesel (Up. Sil.) and at Kozel in Bohemia, this latter a variety with small calicles. The North American, former Lyellia forms, belong to the Niagara and Upp. Helderberg groups.

Propora euryacantha n.

Pl. VIII, figs. 23, 26, 27.

Corallum massive, domeshaped or tuberose. The *calicles*, nearly 2 mill. in diam., are slightly exsert, the elevated rim formed by twelve angular nodules. The septa have no proper lamella but consist entirely of spines, which seen from above are flat, triangular and acuminated and slightly bent upwards. They are densely crowded and rather irregular in their direction.. They vary also in their form, being club- or tongue-shaped. They differ much from those in Pr. tubulata, where they are more acuminate and slender. The *tabulæ* are rather numerous, though in the specimen delineated they are rare and much remote. In some instances they are convex in the middle, being evidently disturbed in their regular growth through the septal spines. The *coenenchyma*, as seen on the surface, is of a certain vermiculate appearance with winding grooves. In transverse sections (fig. 26) the free baculi, which intercross the horizontal dissepiments, are prominent between the calicles with starry sections. In a longitudinal section (fig. 27) their structure is readily perceptible, with their featherlike long staffs, with barbs as it were, standing out at both sides, thus indicating a disposition of the fibrillæ around a central axis. The dissepiment or traverses are compressed between these baculi and almost horizontal or faintly convex and again in other places of the common convex shape.

[1] Geol. Survey of Michigan 1873—76, pl. II, f. 1.

This species is restricted to the higher limits of the stratum *d* and also in *f* in the northern part of the isle of Gotland and has been found in the isle of Fårö, at Ryssnäs, Dember, Alnäse and Lansa, and also at Ar and Slite.

Propora conferta. E. & H.

Pl. VIII, figs. 32—39; pl. IX, figs. 1—23, 31, 32, 35.

? 1819. Madreporites mammillaris WAHLENBERG. Petref. Suec., p. 98. Probably the same species, as he gives Ålleberg as locality, where this is the only Propora.
1851. Propora conferta E. & H. Pol. Palæoz., p. 225.
1858. » » p. p. FRIEDR. SCHMIDT. Untersuchung, Archiv, p. 225.
1860. » » E. & H. H. N. Cor. III, p. 242.
1865. Heliolites affinis BILLINGS. Canad. Geol. and Natural., 2 Ser., vol. II, p. 427.
1866. » » ID. Catal. Foss. of Anticosti, p. 5, 30, fig. 12.
1871. Heliolites dubia TÖRNQUIST. Lagerföljden i Dalarne, p. 19.
1873. Plasmopora conferta p. p. LDM. Sv. Undersiluriska koraller. Öfversigt Vet.-Akad. Förhandl. N:r 4, p. 24.
1873. Plasmopora affinis LDM. Ibid., p. 25.
1880. » conferta ID. Fragm. Silurica, p. 33, Tab. I, f. 6—7.
1880. » affinis ID. Ibid., p. 33, Tab. I, f. 8—9.
1882. » » ID. Silur. Korall. aus Russland, p. 13.
1883. Propora conferta F. ROEMER. Leth. Geogn., I, p. 512.
1888. Plasmopora conferta LDM. List. of foss. Fauna Sweden, I, p. 19, 23.
1888. » affinis ID. Ibid., I, p. 23.

The first authors of this species gave no figures of it and a very short description and said themselves that it »n'est encore qu'imparfaitement connue». It was therefore of the greatest importance to know the specimens upon which they had founded their species. With the greatest readiness Professor HENRI DOUVILLÉ, the distinguished keeper of the museum of »Ecole des Mines» in Paris answered my application to see them and placed them in my hands for examination. These two specimens had been collected by M. E. DE VERNEUIL during his Voyage in Russia in 1844 together with Sir ROD. MURCHISON. One is from Borkholm, the other from »Chavli Canal de Windau», but the latter is probably not found in situ as there are no Silurian strata near that place. The accompanying labels in the hand of JULES HAIME, as Prof. DOUVILLÉ assures, are signed »Propora 2», this number meening the second species of their new genus Propora, which in their works is just this. As I was at liberty to make the necessary sections out of them I could with certainty identify a number of specimens from other localities. I then also found that Heliolites affinis BILLINGS, of which I had received typical specimens from the author, almost entirely coincided in its structure with the Propora conferta, only differing a little as to the size of the calicles etc. That it should be regarded as identical with this species, I hope the sections on plates VIII and IX will also sufficiently show.

It has grown in disciform or sphæroidal masses and has generally the *calicles* so closely set, that there is very little place left for any coenenchyma. They attain a diameter of 1,5 millim. or even less in those formerly called »affinis». They are only slightly exsert

and the margin is crenulated by twelve small nodules. As seen in the pl. XI, fig. 11 there are in the same specimen quite regular, smooth, circular calicles along with crenulated ones, the former being probably younger or more recently formed than the crenulated, as is so evident in Dploëpora. There are for the rest no vestiges of broader septal laminæ in the calicle and consequently no spines. The interior walls of the calicinal tube have only the usual fluted appearance. The *tabulæ* are horizontal or a little wavy, more or less remote. In calicles of the oldest variety the tabulæ have formed a number of small grooves near the wall around the septa (pl. IX, f. 4) in a certain way a sort of septal grooves. On their superior surfaces, as also around the interior side of the calicle some specimens (pl. VIII, f. 32—34, pl. IX, f. 1—2) bear numerous small spines, resembling the aculæ. They seem to be of a later inorganic growth, consisting, as in the original specimen from Borkholm of arragonite. In a specimen (pl. VIII, fig. 35) the septal ends are covered with druses of arragonite.

The *coenenchyma*, as seen on the surface, is coarsely granular with shallow dimples between the granules. It consists entirely of convex lamellæ without the least trace of aculæ growing on them, and this feature, as well as the total want of septal spines makes it distinct from other Proporæ.

Amongst varietal forms may be cited that from Ålleberg, Sweden (pl. IX, f. 9—10) with its thick theca and closely set calicles. Probably the specimen from the stratum *a* of Gotland (pl. IX, f. 31, 32, 35) is related to this variety, but the thick-walled calicles are there more closely set, in contact, and the coenenchyma consequently highly reduced.

This species is chiefly a Lower Silurian fossil though also occuring in the Upper Silurian of Estland and rarely in Sweden. The Swedish Lower Silurian localities are Ålleberg in Westergötland, Sandvik in Öland, Boda, Osmundsberg, Östbjörka and Arfvet in Dalecarlia, all belonging to the Leptæna limestone or the Brachiopod-schists. From Estland I have seen specimens found at Borkholm, Pyhalep and Grossenhof in Dagö, Pattakumeggi near Hapsal. From Norway I have specimens found in the islets Malmö and Malmökalven in the Christiania-fiord and from Asker. In the Upper Silurian of Gotland it has been found in the stratum *a* near Wisby, at Walve ref and Gnisvärd, in detached fragments, at Klef in Sundre and Hoburg in the stratum *d*. In Estland it occurs at Selja pank near Taggamois in Oesel, Herkull (G^1), Helterma (G^1), Kallasto in Dagö (G^2), and Ruhde (H). The Upper Silurian specimens are entirely of the affinis type, as represented by the Anticosti specimens from Junction Cliff. The Museum of Stockholm also possesses a specimen from the middle Tunguska, 22 verst above the mouth Severnaja.

To this species also in all probality belongs a coral, which in several specimens together with other fossils formed a collection belonging to the Mining Corps of Russia, brought home by the Mining Engineer W. OBRUTSCHEW, geologist to the Expedition of POTANIN, in 1894, and found in the East Kwen-Lun Mountains. It is figured on plate IX, figs. 5 & 6 and is derived from two localities, near the river Tsien-shui below the hamlet Kaien-tze-pu and from the hamlet Tschuan-tou-pa on the same river. I owe to the kindness of the Chief geologist TSCHERNYSCHEV the permission to see this collection.[1]

[1] The other corals in this collection were: Favosites Forbesi E. & H., Fav. asper aff., Fav. maximus QUENST., Syringopora sp., Ptychophyllum sp.

Propora conferta, var. *minima* n.

Pl. IX, figs. 24—26.

It has grown in disciform flats, with calicles of the most diminutive size, only 0,5, in the whole family. They are perfectly circular, smooth without the least vestige of septa or septal flutings or cannelures. In the narrow tubes the tabulæ are regularly horizontal and the coenenchyma is almost vesicular of equal-sized lamellæ without any aculæ.

It has been found in the stratum *a* near Wisby.

Propora cancellata n.

Pl. IX, figs. 27—30.

Coral forming tuberose masses without epitheca. *Calicles* a little more than one millim. in size, with crenulated margin, else without septa and in a section deeper down having the calicles quite circular and smooth. The *tabulæ* are regularly horizontal. The *coenenchyma* is on the surface reticulated with irregular tubuli which, however, do not stretch deeper down, as there is no vestiges of them in a longitudinal section in which the convex laminæ are provided with only a few scattered aculæ. In the transverse section (pl. IX, f. 28) there are still vestiges of the tubuli, but I suppose that here, as well as in a few other Plasmoporinæ, there are only the transversally sectioned convex lamellæ which assume a deceiving appearance of tubuli.

This species occurs in the Lower Silurian beds of Borkholm (F^2)

Propora speciosa. BILLINGS.

Pl. IX, figs. 40—46, pl. X, figs. 1—5.

1865. Heliolites speciosus BILLINGS. Canadian Naturalist and Geologist, Ser. 2, vol. II, p. 426.
1866. » » ID. Catal. Foss. Anticosti, p. 30, fig. 13.
1889. » » MILLER. N. Am. Geol. & Palæontol., p. 192.

Some years ago the State Museum at Stockholm received a typical, well preserved specimen of this species from the late Mr BILLINGS. I will at first describe this specimen, in order to show the identity of specimens from a few other localities.

The polypary is clavate or pyriform elongated, bearing large *calicles* all around, a little more than two millims. in diameter. The *theca* is circular, starformed, crenulated by twelve angular indentations, continuing downwards as septal ridges bearing short, densely packed spines. The outgoing angle of the wall is at its apex provided with a little rounded prominence, similar to the tops of the baculi which project from the coenenchyma. The septa are in several instances visible (pl. IX, figs. 42, 44) as diminutive spines close to the theca. The tabulæ are characteristically remote from

each other, generally a little wavy and on their upper surface in some instances covered with short, blunt spines. The coenenchyma is composed of irregular lamellæ forming a tissue of large bladders. These lamellæ are in a few places traversed by thick longitudinal baculi, which stand out on the surface as small rounded nodules pl. IX, f. 40.

Exactly on the same plan the specimens from the other localities are built, as may be seen by the figures. The only difference lies in the size and proximity of the calicles and the shape of the polypary. In all the size of the calicles is nearly half that of the Anticosti specimens and in the specimens from Borenshult the calicles are nearly contiguous leaving very little space for the coenenchyma. The shape of their polypary is almost sphærical, in some instances pyriform. The English specimens (fig. 43) are a little altered and the septal ridges have acquired an irregular aspect.

More deviating is the specimen from Bara, Gotland, which has been delineated on plate X, figs. 3—5. It is a discoid polypary, with exsert calicular margins, ornated with twelve thick, oviform nodules, and without other vestiges of septa than interior longitudinal ridges without spines. The tabulæ are rather concave. The coenenchyma is of the common vesicular kind with short, thick rods scattered in it and the peculiar nodulose appearance of the surface of the coenenchyma is caused by the protruding of these rods through the coenenchymal lamellæ. As this variety, which perhaps can be seen in the light of a mutation, on the whole comes more near to this species than to any other, I have united it with these forms.

This species has the greatest affinities with a following species, the Lower Silurian Pr. bacillifera, which, however, has large septal spines and a greater number of larger bacilli in the coenenchyma.

Pr. speciosa is an exclusively Upper Silurian species being in Sweden found at Borenshult in Östergötland, and at Bara backe in Gotland. Further at Dudley in England and at the Junction cliff of Anticosti (in BILLING's Middle Silurian).

Propora compacta n.

Pl. X, figs. 6—7.

1883. Hel. interstinctus LINDSTR. Silurische Korallen aus Nord-Russland, p. 19.

Polypary discoid with closely set calicles of a diameter of one mm. enclosed within a thick theca, angularly bent in twelve short in- or outgoing points or angles, the interior ones having the character of short septa not visible in vertical sections. These angles give both sides a fluted appearance. The tabulæ are close, nearly horizontal or bent in convex curves.

The coenenchyma is of a mixed vesiculose-tubular character, consisting of thick and long bacilli, which packed in the narrow intercalicinal spaces coarctate the dissepiments, that have small dimensions, but the common convex form. By their proximity and great number they give the frame of the polypary an appearance of compactness.

This species comes near to Prop. speciosa but differs in a being entirely without any septal spines in the calicles and in having the vertical element of the coenenchyma more fully developed.

It has been found near the river Olenek, Sibiria and also on the shores of Petschora in north Russia.

Propora bacillifera n.

Pl. X, figs. 8—21.

As to the synonymy of this exclusively Lower Silurian species I have no certain data, to which to refer, but it is highly probable that a great number of specimens of it from the Baltic and North Germanic localities have been called Prop. tubulata, by various authors.

This coral has grown in pyriform, elongated or globular masses, also sometimes disciform.

The *calicles* attain in some localities as from Hulterstad in Öland (fig. 12) larger dimensions than is general amongst the Heliolitidæ, viz. 3 mm. in diameter, the other specimens having only 2 or even 1 millim. The calicles are surrounded by a thick theca, having the shape of a twelve-pointed star. The interior angles of this star make the basis of the septa from which long, pointed, upwards directed spines project, placed remote from each other. The septal lamella proper is reduced to a narrow ridge, scarcely perceptible in a longitudinal section. Owing to the long spines the remote tabulæ are not regularly grown, often curved or convex.

The *coenenchyma* is a tissue of large bladders, the convex laminæ forming it being of the largest kind. It is penetrated by numerous long, slightly curved remote rods or bacilli, having the same colour as the theca and the septa (figs. 9 and 20) and finish upwards in a fine point. In transverse sections they ressemble small black dots between the calicles (fig. 16). They grow evidently faster than the convex lamellæ and in advance of them as they on the natural surface of the corallum stand out above these lamellæ.

There can be observed certain local variations; so for instance, the Öland specimens (fig. 15) have shorter bacilli fixed on the lamellæ, as large aculæ. In the specimens from Hohenholm, Dagö, the septal spines do not attain the same length as in the specimens of older geological age.

It has been found at Treberga in the parish of Hulterstad, Öland, at Osmundsberg and Östbjörka in Dalecarlia, at Hohenholm in Dagö, at Piersal (F^1) and Borkholm (F^2) in Estland, very abundant in the last locality, also in Norway at Herö near Porsgrund and is consequently chiefly a Lower Silurian species. In detached fragments it has been found on the shores of Gotland, near Wisby and at Westergarn.

Propora? ambigua n.

Pl. x, figs. 22—24.

Corallum disciform, with concentrically wrinkled epitheca. *Calicles* with low, only faintly indented margin and very short *septa*, which are not visible in a longitudinal section. Seen on the surface the *coenenchyma* resembles almost that of a Heliolites, consisting of a regular reticulation of polyëdric tubuli. These seeming tubuli are, however, as seen in a longitudinal section only convex lamellæ cut transversally and causing this false appearance and there are no tubes. There is instead a vesicular tissue, quite of the same nature as that usual in the genus Propora. The convex lamellæ are larger than else, have some sparse aculæ on their culmen, and at certain distances there has been a sort of fasciæ formed through a concentration of the lamellæ and a richer growth of the aculæ. This is especially remarkable near the surface, where the tabulæ and the coenenchymal elements follow so closely upon each other as to form a nearly compact mass. This concentration seems here to depend entirely upon an abnormal growth and is by no means of such a regular recurrence as in Heliolites fasciatus.

The real systematic place of this species may be contested and I have therefore only hesiatingly united it with the Proporæ. It has been found in several specimens in detached pieces from the Arachnophyllum stratum *a* near Wisby and at Skälsö, north of Wisby.

There are still some specimens of Propora left undescribed and undeterminated until more material can be collected. On plate ix, figs. 33—34 a specimen of Propora has been delineated, the only one found, which has not been placed in any of the described species. It is remarkable for its exceedingly large calicles, measuring nearly 4 millims. in diameter, the largest known in the whole group of the Heliolitidæ. The coenenchyma is scarce consisting of large bladders and in so far resembling Pr. speciosa, but there are vestiges of large septal spines, what on the other hand should approach it to Prop. bacillifera. It is Lower Silurian from Alfaret, weast of Hulterstad, Öland. In the lowest Upper Silurian stratum of Gotland, the Arachnophyllum stratum, which has been so fertile in many different species of Heliolitidæ, some Proporæ have also been found, that cannot be referred to any of the known species. So for instance there is one with short and stout septal spines reminding of those of Pr. tubulata, but the much remote calicles are surrounded by a coenenchyma of the most elementar nature, only of transverse, convex lamellæ, without the least traces of aculæ or other vertical elements.

As appertaining to Propora Milne Edwards and Haime have[1] with some doubt cited:

1. *Propora? acerosa* E. & H. (= Porites acerosus Eichwald, Zool. specialis, t. 1, p. 183). It is no Propora, but according to the figure in Eichwald's Lethæa rossica, pl. 26, fig. 4, it is a Favosites and is there by him renamed as Archæopora acerosa.

2. *Propora? cyclostoma* E. & H. from the Mountain Limestone of England, a doubtful species founded on Hydnophora? cyclostoma Phillips, Geol. of Yorkshire, p. 202, pl. 2,

[1] Pol. terr. pal., p. 225.

figs. 9—10. To judge by the figure it is no Heliolitidean at all, rather more related to Calapoecia. Astræopora antiqua M'Coy, Ann. Mag. N. H., 2[d] Ser., t. 3, p. 133, is by E. & H. considered as identical.

Nicholson has in his »Tabulate Corals» and jointly with Etheridge jr. in the »Fossils of Girvan» described some new forms of Propora of which I have identified a few with ours. Their Pr. Edwardsi, Girvan, p. 270, pl. xvii, fig. 3, seems to be a new and independant species and their Pr. tubulata, which differs from that of Lonsdale, probably identic therewith.

I have on plate ix, figs. 36—39 represented a specimen of Pinacopora Grayi Nich. & Ether. being found by Dr J. G. Hinde at the Junction Cliff of Anticosti and by him presented to the Swedish State Museum. Evidently this specimen, as well as those figured by the said authors, has not preserved its original conformation, but has become oblique and deformed by pressure. If it were permitted to judge by such an incomplete specimen there would be no reason for maintaining the genus Pinacopora as there is so very little to distinguish it from Propora. I would prefer at present to let it stand as a synonym to Propora.

From the morainic accumulations of Öjle myr, Gotland (p. 71 above) Dr Wiman has sent me some small complete specimens of a Propora, which possibly are identical with the Pinacoporæ. They form small, nummuloid disks of a thickness of 3 millimeters, flat on both sides. The circular or sometimes oblong calicles measure nearly 3 millimeters in diameter, have a thin, exsert margin, angularly indented in twelve septalike folds, no spines, flat tabulæ. The calicles are deeper than usual. The coenenchyma seems to be entirely vesicular.

Camptolithus n. gen.

(Καμπτός, curved, arched.)

1851. Lyellia E. & H. p. p. Pol. palæoz., p. 150.

The species on which I have founded this new genus was till now placed in the genus Lyellia, but I will try to demonstrate that it is quite incongruent with the typical species, of which Milne Edwards and Haime construed their genus. If we turn to the synoptical table at page 72 we shall in reality find that there is indeed very little, if anything, to distinguish Lyellia from Propora. If we take the coordinate characters one by one, we see that apparently the only dissimilarity consists in the »murailles épaisses et costulées». But if we take »costulées» and compare with the »cloisons» which in Propora constitute »côtes», both characters coincide. And in a corroded specimen of Propora the calicular tubes appear quite as much »costulées» as those of a Lyellia. The circumstance that in the American specimens of Lyellia the calicles are thus laid bare and only a few shreds of the coenenchyma left, seems to have induced some authors, as Neumayr[1] to

[1] Thierstämme I, p. 312.

consider this purely inorganic phenomenon of corrosion as structural or organic and analogous with the exterior tabulæ of Tubipora. According to the authors of the »Polypiers paléozoïques» this genus embraced only two species: Lyellia americana and glabra. Of these I have had occasion to examine the former and I have above page 92 given the results of this examination. As there stated it shows a remarkable coincidence with sections of Prop. tubulata (which see), so nearly concordant, that I do not hesitate to refer them both to the same genus and even species. There may of course be some slight deviations in the septal spines, else these, the coenenchymal lamellæ, sparingly covered with aculæ, the remote tabulæ in the calicular tube are nearly the same.

The next species, L. glabra, I know only through the excellent figures and description of MILNE EDWARDS and HAIME[1] and they suffice for deciding that this also in all particularities corresponds with a real Propora and that it, in case it is an independant species, should be named Pr. glabra.

Since MILNE EDWARDS and HAIME had published their grand works ROMINGER has described[2] three new species, L. papillata, decipiens and parvituba. Of these I have not seen L. decipiens, but the exact description leaves no doubt that it is a coral of the same type as Pr.? ambigua which has been described above and which perhaps constitutes a new generic or subgeneric type.

ROMINGER himself has sent me specimens of his L. parvituba. On pl. VIII, figs. 29—31 I have represented this species. The corallum is disciform, covered by the densely placed small osculating calicles, scarcely one mm. in width. Seen from above the septa are short, thick, some radii extend outside the theca though not in immediate continuation with the septa. Though consisting entirely of limestone, it is interiorly so much altered, as almost to defy any attempt to find out the original structure. Instead of being provided with ordinary septal spines the calicinal tubes are at irregular intervals filled with large numbers of microscopic crystalline glomerations heaped in masses above each other on the tabulæ and on the interior sides adjoining, and in a transverse section they are seen to cover the whole area of the tabula. The coenenchyma is uncommonly irregular; extraordinary large lamellæ intermingled with smaller. The calicular tubes are also of a highly irregular growth, interrupted by coenenchyma as if overgrown by it and then beginning anew. But after all, detracting from the abnormities, this species is so similar in its fundamental constitution to L. americana and glabra that it must be placed in the genus Propora. If now, as I think, these three species which did properly constitute the genus Lyellia have all characters in common with Propora, as well as the allied Lyellia decipiens, and because the only remaining species, L. papillata, as I will show further down, is widely different from the former it follows 1:o) that the genus Lyellia must be abolished[3] and 2:o) that L. papillata constitutes a new generic type.

DAVIS in his »Kentucky Fossil Corals» has given photographic figures of two other Lyelliæ, viz. L. discoidea and L. puella. The descriptive letterpress of his work seems never to have been published and the figures are too indistinct to give any help in identifying.

[1] Pol. terr. pal., p. 226, pl. 12, fig. 2.

[2] Geol. Survey of Michigan, vol. III, pl. II. Palæontology, p. 16—17.

[3] The genus Protolyellia proposed by TORELL does not show the least affinity with Lyellia or Propora and is in fact no coral at all. See for further particulars »Fragmenta Silurica», p. 31.

The fig. 5, pl. 51, L. puella, represents clearly a Plasmopora, possibly Pl. follis, and Pl. discoidea, pl. 4, f. 3 seems also to belong to that genus.

This genus Camptolithus is to be characterized as follows. The calicles are filled with a coenenchymatoid mass of convex lamellæ instead of tabulæ, and when these have sometimes been developed, they form a much curved, convex arch. The septa are little developed and the coenenchyma consists almost entirely of convex lamellæ with scattered aculæ. At present only one species is known, from the Upper Silurian of the Niagara group in North America.

Camptolithus papillatus. ROMINGER.

Pl. X, figs. 25—30.

1876. Lyellia papillata ROMINGER. Geol. Survey Michigan, vol. III, pt. 2, p. 16, pl. II, fig. 3.
1878. » » QUENSTEDT. Petref. Deutschl., p. 150, pl. 149, figs. 7—8.
1885. » » DAVIS. Kentucky Foss. Corals, pl. 2, f. 2(?), pl. 3, f. 1, pl. 4, f. 4 (bad specimen).

Through decay, being weathered, and through silicification it has been much deformed and shows an exterior similarity with L. americana in having the tubes of the calicles partially standing free and laterally connected by horizontal shreds of coenenchyma, that have withstood destruction. The transverse section shows large *calicles* (2,5 millimeters) provided with twelve short septa, the theca angular or indented in face of them. Through changes during the process of fossilization the septa have assumed quaint shapes, they are cuspidate with hooks or barbs on the sides and in their apex (pl. x, fig. 25) and there are small accessory, septalike spines. The centre of the tabulæ is dotted with a great number of small spines, figs. 25, 27, which possibly may be of organic origin. The calicle, instead of having regular horizontal tabulæ, is filled with convex tabulæ, fig. 30, elevated as an arch in their centre and often so crowded that they interfere with their regular growth and consequently there arises a tissue of smaller convex tabulæ giving the whole an appearance quite similar to the ambient coenenchyma, figs. 28—29. By this the perfect homology of tabulæ and the coenenchymal dissepiments is clearly demonstrated. The *coenenchyma* is composed of nearly equal-sized lamellæ, having sometimes a tendency to be arranged in longitudinal rows (pl. x, f. 30) without being separated through bacilli. Of such there are some (f. 29) in another specimen even in the calicle, but aculæ are dispersed everywhere on the lamellæ. As seen in fig. 26 there are vestiges of costal radii emanating from the theca and the photographic figures of ROMINGER and DAVIS exhibit also such radii. The calicles are much distorted and defaced by later changes.

The Swedish State Museum is in possession of specimens from Point Detour, Lake Huron, Michigan, the only place from which it has been obtained. The specimens were given by Dr ROMINGER.

Diploëpora. QUENSTEDT.

1851. Heliolites p. p. E. & H. Pol. terr. pal., p. 217.
1881. Diploëpora QUENSTEDT. Petrefaktenkunde Deutschl., p. 148.

This genus is most remarkable through having two widely different sorts of coenenchyma (pl. XI, f. 4), an older and interior one entirely of proporidean, vesicular character, and a younger and exterior of a peculiar nature, rather coccoseridean, composed of closely packed, parallel rods or baculi, being of the characteristic featherlike structure. It was in consequence of this double nature of the coenenchyma that QUENSTEDT gave it the apt name, derived from the greek *Διπλόη* = duplication. As to other particulars, they shall be described in detail further down.

Diploëpora Grayi. E. & H.

Pl. X, figs. 31—38, pl. XI, figs. 1—4.

? 1837. Blumenbachium globosum LONSDALE. Sil. Syst., pl. 15, f. 26; according to E. & H., Pal. Foss, p. 217, only a cast of this species.
1851. Heliolites Grayi E. & H. Polyp. terr. pol., p. 217.
1855. » » IID. Brit. Foss. Corals, p. 252, pl. 58, f. 1, 1*a*.
1860. » » IID. H. Nat. Cor. III, p. 238.
1867. » » LINDSTR. Nomina foss. Gotl., p. 27.
1878—80. » » NICHOLSON & ETHERIDGE. Girvan, p. 58, 252, pl. IV, f. 4, 4*a*, pl. V, f. 1. It is uncertain whether all their specimens really belong to this species.
1879. Diploëpora Grayi QUENSTEDT. Petref.-Kunde Deutschlands, Abtheil. I, Bd 6, p. 147, pl. 149, figs. 2, 3, 4.
1883. Heliolites Grayi FERD. ROEMER. Lethæa Geogn., p. 508.
1885. » » LDM. List of Gotl. Foss, p. 18.
1888. » » ID. Foss. Faunas of Sweden II, p. 21.

This species is distinguished from all others in the family through its mode of growth. It is dendroid, branching in terete, fingerlike ramifications or irregular trunks. The English variety is characterised by flat, compressed branches with the dimensions of 45 × 5 millim. taken from one specimen. There are fragments of Gotlandic specimens from Ryssnäs in Fårö, measuring 22 decim. in length and 35 centim. across the branches in thickness, proving that it has been one of the largest corals in the Silurian sea.

It is on all sides covered with tiny, closely set *calicles*, attaining a diameter varying between 0,5—0,8 millims. As may be seen by pl. X, figs. 32—35 they have a different shape according to their state of development, fig. 32 representing the youngest, just beginning stage, fig. 35 the mature or fully developed one. It is interesting to study these as they elucidate the procedure of the formation of the theca and the septa more evidently than in any other Heliolitidean and consequently are of value for interpreting the origin of the said structures also in other species.

It is in the top of the branches that the youngest calicles grow out (f. 32). Their thin edges are regularly circular and smooth (pl. XI, fig. 3) and the first sign of change lies in a curious plication of the thecal edge, only a single one, but visible in several calicles of the same level and in all directed in the same way. Next (f. 33) the edge is incrassated and twelve nodules begin to appear on it, first irregularly, then (f. 34) ordinated regularly around the aperture, like rounded balls covered with small warts. These three calicular forms are from the same specimen. The next, the complete stage, (fig. 35) is taken from another specimen found at Ryssnäs, Fårö. The tubercles are smooth and the septa, which were not visible in the next preceding stage, are at last formed showing their spines in twelve rows. The tubercles should not be taken as belonging to the septal apparatus as they are histologically identical with the baculi which surround them as coenenchyma. The same tale is told through a section as in pl. XI, f. 4. The calicles in the youngest stage, immersed in the central stratum, are of the most elementar character with regular horizontal tabulæ and without any septa. It is quite the same when they are (fig. 2) on the verge to enter into the bacular coenenchyma. There is an indication of a sort of columella in them in the centre of the tabula. In fig. 1, pl. XI, we see the complete change in the arising of scarce, blunt septal spines, as it seems emanating directly from the inner side of the theca without any lamella.

The aspect of the *tabulæ* is also changed, they are thinner, closer and more irregular, wavy or concave, when then calicles are more fully developed. *Pari passu* with the changes in the calicle succeed the alterations of the *coenenchyma*. Of its two transformations we find the simple, vesicular to be the first. It is of the most elementary nature (fig. 4, pl. XI), small convex, equal-sized lamellæ as in some Proporæ, for instance Prop. conferta, and like this without the least vestiges of vertical elements. On the surface it presents the aspect as shown in pl. X, figs. 32 & 33. The second modification of the coenenchyma which arises, so to say, suddenly, is entirely composed of that vertical element for which I have proposed the name of baculi. They are evidently of equal structure with the rods which make up the sceleton in several other corals as for inst. in Heliopora or scattered in the coenenchyma of Prop. speciosa. These baculi of Diploëpora lie closely packed alongside each other with distinct lines of separation and this part of the coenenchyma thence receives a streaked appearance. A single baculus varies in length from 0,8 mm. to 0,5 mm. and its diameter is 0,3. In a transverse section (pl. X, fig. 37), where they lie arranged as a mosaic pavement, they have an irregularly polyëdric outline and a radiated surface, the radii diverging all round from the centre. This stratum forms a tuberculous surface as seen in pl. X, fig. 35. In a longitudinal section they have the formerly described feathery appearance with the fibrillæ on both sides directed upwards from an axial line. The nodules around the calicles are exactly of the same nature, only a little larger (pl. X, f. 37, pl. XI, f. 1) and compose the whole theca. This must far down have changed from its primarily simpler state, when it was environed by the vesicular coenenchyma as in fig. 32, pl. X. In the section pl. X, f. 38 it has acquired the baculi and from some of them prolongations like septa go towards the centre. But it is there environed by a vesicular coenenchyma with traces of some baculi beginning to appear.

As represented in the section fig. 4, pl. XI at right in the bacular coenenchyma there is a recurrence of the vesicular one repeated no less than six times more or less distinctly. The thickness of the different strata amounts to 1,3 cm. for the central vesicular and to 1,1 cm. for the bacular one at the right hand, the small enclosed vesicular bands comprised.

Coenenchymal gemmation occurs and an instance thereof may be seen on the fig. 1*a*, pl. 58 in MILNE EDWARDS' and HAIME's British Corals.

By the gradual development of the different parts we learn, as also has been ascertained by other facts, that in the Heliolitidæ the theca is the first part of the coral formed, that it long persists in its original simplicity, that by and by new deposits are added to it and that at last the septa are formed, so that at least in this group of anthozoa there can be no telling that the theca is constructed through the connection of the before existant septa.

What physiological significance the sudden conversion of the vesicular coenenchyma into the bacular may have, it seems that the coexistense of these two widely different structures in the same specimen may be of phylogenetic value and joint with the knowledge we have gained of the ambiguous nature of Propora? ambigua and its nearest ally Prop.? (Lyellia) discoidea ROM. points to the Proporæ as the parents both of the Plasmoporæ and the Heliolitæ. But Diploëpora has been developed in still another direction. It changed its Proporean nature into one, the counterparts of which we detect amongst the Coccoseridæ, especially in the genus Acantholithus. Thence Diploëpora may in the systematic arrangement fitly be placed last amongst the Plasmoporinæ, but as one of them, next before the Coccoseridæ.

This beautiful and highly interesting species is very common in the Upper Silurian strata, especially in the isle of Gotland. In the lower strata (*bc*) it has only been found at Stora Carlsö. In the higher strata from *d* to *h* it occurs at Ryssnäs, Lansa, Dember (all *d*) in Fårö, along the shores of Fårösund at Wialmsudd, the canal of Stor myr, Rute, Bunge, the quarry at Storugns in Lärbro, Vägume vik, Lergraf, Tjelders and Laxarfve in Boge, Hide vik, the shore north of Länna, and the hill of Länna at Slite, at Klints in Othem, Fole, Bara, Follingbo, at Wisby in the strata *f*—*h*, and the west coast of Lilla Carlsö stratum *f*. I have had specimens to examine from Kirna and Ruhde in Estland both belonging to the higher Upper Silurian and also from Wenlock in England.

I may here remark, that the same conformation of the calicular theca as in Diploëpora also seems to prevail in some Proporæ, as Pr. tubulata (pl. VIII, f. 8, 11, 12) and especially Pr. speciosa (pl. X, f. 3, 4) where the theca of the mature calicle comes very near to that of Diploëpora (pl. IX, f. 34). In Pr. cancellata the younger calicles have completely circular margins (pl. IX, f. 28) while the mature calicle has them of the same type as in Diploëpora. As a rule the indented or starshaped theca belongs to a later stage of growth in a great number of the Heliolitidæ. Compare also Pr. conferta pl. IX, f. 11 with pl. VIII, f. 33.

Tribus III. **Pycnolithinæ** n.

The characters of this tribus are the same as that of the next genus the only one having hitherto been found.

Gen. *Pycnolithus* n.

(Πυκνός, dense.)

The calicle is of the common Heliolitidean type with twelve septa and horizontal tabulæ. The coenenchyma is dense, only on the surface ornamented by shallow grooves and pits of contorted, lengthened outlines, filled up a little below the surface, so that the whole coenenchymal mass is thick and compact without any structure, only traversed by the whitish, longitudinal stripes which denote the thecæ between the superficial grooves.

Pycnolithus bifidus n.

Pl. XI, figs. 5—9.

The polyparium is disciform with an even surface and immersed calicles. The *calicles* are small, scarcely one millim. across. On their interior side there are twelve broad, short, blunt prominences which are homologous with the short septa of several Heliolitidæ. They have besides the peculiarity of being bifid through a small indentation along their margin. In a longitudinal section they are not visible. The interior of the calicular tube is partitioned by regular, somewhat distantiated tabulæ, a little concave and through later deposits much deformed. The *theca* is of unusual thinness and is discernible only as a narrow white lining around the aperture of the calicle. The *coenenchyma* consists near the surface of narrow, vermiform grooves, separated through thick partition walls. These cavities are very shallow and extend only to a trifling depth below the surface, giving to this in a longitudinal section (pl. XI, fig. 8) a crenulated appearance. Below, there is all a compact mass of a grayish tint, finely granulated, traversed longitudinally by threadlike, white lines being the narrow thecæ, surrounding the grooves of the surface. In a transverse section they are seen as a net of white lines including the grayish mass (figs. 6—7).

This interesting Heliolitid was found in a detached piece on the shore near Wisby amongst other Gotland fossils and the appearance of the rock to which it is adhering, makes it highly probable that it has been derived from some of the lowest beds, the Stricklandinia bed (*b*) or the next (*c*).

Fam. **Coccoseridæ** n.

As a coordinate family to the Heliolitidæ and related to it, with some of the species of which it has been confounded, that of the Coccoseridæ is to be mentioned. Like the Heliolitidæ its corallum is composed of calicles with twelve radiate septa, but without any distinct theca, with a more or less abundant coenenchyma, which is completely filled with the large erect baculi of which it consists, lying close to each other and only on the surface separated through narrow grooves, which give the false appearance of tubuli. Consequently there are generally no dissepiments in the coenenchyma nor tabulæ in the calicles,[1] the central part of which is filled by long tubular rods emerging on the surface as small papillæ. A common character for all these is that they have grown in exceedingly thin lamellæ, scarcely surpassing a few millimeters in thickness.

The genera which I think may be placed within this family are three:

1. *Coccoseris* Eichwald.
2. *Protaræa* E. & H.
3. *Acantholithus* n.

They are all exclusively Lower Silurian.

Gen. *Coccoseris.* Eichwald.

1860. Eichwald, Lethæa Rossica I, I, p. 442.

The corallum has grown in thin lamellæ, disciform, with a concentric epitheca; the calicles with broad, triangular septa, surrounding numerous papillæ on the central area. No tabulæ. Coenenchyma with narrow, funnelshaped, shallow tubes enclosed by thick compact walls, often papillose or scrobiculate on the edges. For the rest entirely composed of large baculi of the fibrous structure. The species of this genus are geologically distributed as indicated in the following table.

	Lower Silurian.			Upper Silurian.
		Leptæna limestone.		
	Bala.	Lyckholm.	Borkholm.	
		F^1	F^2	
Coccoseris Ungerni Eichwald		*		
microporus Eichw.			*	
megastoma M. Coy	*			
var. minor		*		
micraster n.			*	

[1] Some specimens of Acantholithus make exceptions.

Coccoseris Ungerni. EICHWALD.

Pl. XII, figs. 3—7.

1855. Lophoseris Ungerni EICHWALD. Bull. Soc. Nat. Moscou, p. 466.
1860. Coccoseris Ungerni ID. Lethæa rossica, vol. I, 1, p. 442, pl. XXV, fig. 4*a*—*c*.
1883. » » FERD. ROEMER. Leth. Geogn., 1r Th., p. 456.

It has grown in disciform polyparies of exceeding thinness, commonly one or two millimeters and in tiers of lamellæ above each other. It has not been attached as seen by the free and finely striated epitheca. The *calicles* attain 1,5 or nearly 2 millim. in diameter. They are not separated from the coenenchyma by any distinct theca. There are twelve triangular, broad and somewhat sinuous septa, attaining a length of $^2/_3$ of the distance from the margin of the calicle to its centre. Their surface is coarsely decorated with blunt tubercles and the dividing grooves between them are sinuous. The central area of the calicle is covered by several irregular papillæ some of them in continuation with the septa. There are no tabulæ in the interior and the whole calicular tube is filled with the septa and in the middle with long prismatic baculi of the common fibrous structure, as seen pl. XII, f. 6—7 in longitudinal and transverse sections and it is their tops which project in the calicle as papillæ. In sections the septa are also seen to consist of rods of the same pinnate structure, but they are oblique and directed upwards and inwards, being a little curved, thus upon the whole reminding of the septal spines in the true Heliolitidæ, but cohering and forming a lamella (pl. XII, f. 7).

The *coenenchyma*, which upon the whole is scarce between the closely set calicles, is tubercular with small papillæ or pitted by irregular holes, not very deep and enclosed within thick walls, depending on the state of preservation, as the specimens with pits are weathered. The mass of the coenenchyma consists of baculi (figs. 6—7, pl. XII).

I have examined specimens from Grossenhof, Kerküll, Sutlep in Estland and from Hohenholm in Dagö (F^1) and Oddalem. A fine specimen has been found detached on the shore near Wisby, provenience problematic. No specimens hitherto found *in situ* in Sweden.

Coccoseris microporus. EICHWALD.

Pl. XII, figs. 12—15.

1856. Heliolithes microporus EICHW. Bull. de Moscou I, p. 89.
1860. » » ID. Lethæa rossica, vol. I, 1, p. 454, pl. XXV, fig. 7*a*, *b*, *c*.
1883. » micropora(!) FERD. ROEM. Leth. Geogn., p. 509.

It has grown in an exceedingly thin lamina of 1,5 millim. in thickness, extending its surface in a specimen over a length of more than 3 centim. Diameter of calicles nearly one millim., no theca. The *septa* have a rather indistinct outline, being fringed by large tubercles which without dividing lines are mixed with those of the area, in consequence of what it is often difficult to see where the septum ends and the central area

begins. The papillæ of this area are of greatly unequal size, some coalesced into larger heaps. They may also be placed in a radiate manner, as if continuations of the septa. The calicular tube contains only vertical baculi (fig. 13) and no tabulæ.[1] The *coenenchyma* which also consists of baculi has on the surface numerous starry pits separated through thick walls, finely granulated or scrobiculate. In the longitudinal section there are lacunæ, probably caused by dissolution of the sclerenchyma.

In the fig. 15 EICHWALD's original specimen has been anew delineated in order to show the identity of the other specimens figured. It is preserved in the Geological Museum of the University of Petersburg and through the kindness of Prof. INOSTRANZEFF I have been able to examine it. It is a small thin piece of whitish limestone, much worn already before its being embedded in the limestone stratum during the Silurian period. In comparing this with other specimens from Estland there can be no doubt but that they all belong to the same species.

It is known only from Estland where it has been found at Borkholm, Kurküll and at Maals near Hapsal, the locality of EICHWALD's specimen, this probably not *in situ*.

Coccoseris megastoma. MAC COY.

Pl. XII, figs. 8—11.

1851. Palæopora megastoma M'COY. Brit. Palæoz. Fossils, p. 16, pl. IC, fig. 4; not Porites megastoma M'COY, Syn. Sil. Foss. Ireland, tab. 4, f. 14, to which M'COY refers, but which is quite different.
1854. Heliolites megastoma M. EDW. & H. p. p. Brit. Foss. Cor., pl. 58, figs. 2*c*, 2*d*.
1854. » interstincta M. EDW. & H. ibid., pl. 57, figs. 5*c*, 5*d* probably also belongs to this species.

It has probably, to judge by a variety described below, grown parasitic as a thin lamella. The calicles are closely set with 1,5 millim. in diameter. The *septa* are short, broad, triangular with some irregular tubercles on their surface. The large central area is covered with numerous small papillæ. The *coenenchyma* is coarsely pitted with narrow, funnelshaped perforations and the separating walls project as blunt spines.

The figure given is taken from a cast, obtained through an impression of the coral in a piece of slate, found by Lector S. L. TÖRNQUIST at Applethwaite in Westmoreland, from where M'COY as well as MILNE EDWARDS and HAIME also had their specimens, likewise being negative casts.

Judging by the above cited figures there cannot be any doubt left of the identity of my specimen with theirs. In MAC COY's figure the papillæ of the central area are more clearly indicated than in those of MILNE EDWARDS.

With this species I join a variety of smaller dimensions, found in the Swedish Lower Silurian at Hulterstad in the isle of Öland. It has been figured on plate XII, figs. 9—11. Of the specimens found the best has grown on the calicles of Heliolites hirsutus,

[1] EICHWALD has in his fig. 7*c* drawn the longitudinal section as if composed of regular tabulæ, but no such are found in his original specimen.

where it forms a thin polypary with the dimensions of 15 × 7 millim. The thickness of the whole amounts only to 0,5 mm. The tiny calicles are scarcely 0,5 millims. in diameter, the short septa triangular with small tubercles on their surface and larger ones on the central area. The coenenchyma is bristling with blunt points surrounding irregularly stelliform pits. In the weathered specimen figured (fig. 11) from the same locality the spines are gone and the funnelshaped pits are more visible. If this variety, which belongs to a higher horizon than the English species, must be denominated, I propose to call it Cocc. megastoma, var. minor.

Coccoseris micraster n.

Pl. XII, figs. 16—18.

This little coral has the form of a sphæroid of only 13 millims. in diameter. The stellulate *calicles* have a diameter of only 0,3 millimeter, being the smallest known of all described in this memoir. They are remote from each other and they radiate from the initial centrum towards all points. The septa, as seen on the surface, are triangular, broad and stretch near to the centre of the calicle, where there are two or three columellar tubercles. In a longitudinal section the septa are well conspicuous, being of the same structure as in Cocc. Ungerni with the characteristic curved baculi. The large columella, formed of baculi also exhibits the pinnate structure. The coenenchyma, which is copious, consists of minute stellulate pores, surrounded by the chief mass of thick, closely packed, straight baculi, of the common pinnate structure, which is here well represented. There are no dissepiments at all.

This species is known only from a single specimen found by the late Mr WEGELIN, to judge by the colour of the rock from Östbjörka, Dalecarlia, consequently from the Leptæna limestone.

Gen. *Protaræa*. M. EDW. & H.

1850. Astræopora D'ORB. Prodr. I, p. 25.
1851. Protaræa M. EDW. & H. Pol. terr. pal., p. 146.
? 1856. Diplastræa EICHWALD. Bull. Moscou, p. 111.
1866. Stylaræa VON SEEBACH. Nachrichten von der K. Gesellsch. der Wissenschaften zu Göttingen, p. 238.

Corallum growing in a thin crusta on brachiopoda and shells with close set or contiguous calicles, between which there is no coenenchyma or very little of it, distinguished by shallow pits. Twelve granulated septa surround the papillæ in the centre of the calicle. No tabulæ, nor dissepiment. Entire sceleton made up of closely united, robust baculi, showing the pinnate structure forming a compact mass.

There is nothing in the sclerenchyma of this genus that justifies its being placed in the order of the Perforata of MILNE EDWARDS and HAIME as it is an almost solid mass

of compactly united baculi, not at all showing the spongy texture of the Perforata. Taking in consideration the constant and distinctive character of all the corals of this group to have twelve septa, it is not probable that Protaræa Verneuili (Hist. Nat. Cor. III, p. 185) with its twenty septa belongs to this genus, nor to this family. When the authors just cited write »portant aux angles de la plupart des calices de petites pointes saillantes», they must mean the rounded warts which are so prominent during the first stages of the growth of this coral and in the mature polypary are faintly discernible on the dividing walls between the calicles and not only in the corners.

Nor can I find any reasons with ROMINGER and FERD. ROEMER[1] to see affinities with the protean Thecia. There are no communicating pores between the calicles nor are there any vestiges of tabulæ as they and also SARDESON[2] pretend. The figures 20, 22, pl. XII present the true aspect of the interior structure.

As to SEEBACH's Stylaræa the following remarks may be given. Even if the species named Styl. Roemeri by VON SEEBACH[3] is to be maintained as an independant species, the generic denomination must be entirely abolished on the following grounds.

In 1851 MILNE EDWARDS and HAIME had already established[4] a genus Stylaræa amongst the Poritidæ for a single recent species, Stylaræa Mülleri, quite different, even generically, from the palæozoic fossil. But already in the same year (1851) they abolished[5] this genus and registered it as a true Porites, identifying their Styl. Mülleri with the Linnean Porites punctatus. SEEBACH seems not to have been aware that the name he gave his new genus had been already preoccupied and again cancelled. In consequence it must for ever be kept in disuse.

As to the fossil itself, described by SEEBACH as Stylaræa Roemeri, I have been enabled, through the kindness of Professor VON KOENEN, to examine his original specimen, which belongs to the Roy. geological-palæontological Museum of the University of Göttingen. It is figured anew, partially, on the plate XII, fig. 24. It is a thin lamina, scarcely two millimeters in thickness, with a finely wrinkled epitheca. It is to be borne in mind, that the superior surface with the calicles is much corroded by weathering, so that it is impossible to detect a single fresh or intact calicle. In all particulars it may, for the rest, be compared with Protaræa vetusta (fig. 19) having like this species twelve tuberculate septa, a flat or slightly convex area covered with numerous papillæ; the only appreciable difference being that the walls of the calicles are a little broader. There is not the »schwammige Columella», which SEEBACH thought he saw, but the uppermost pointed tops of the columnar baculi, which fill the centre of the calicle, quite as in Protaræa or in Coccoseris. As to the points (»Zacken») in the corners of the calicles, there are several such almost everywhere on the thecæ. The spongious tissue of the coral, which should unite it with the recent Litharææ is only seeming, owing to the highly corroded surface. In

[1] Lethæa geognostica, 1r Theil, p. 455.
[2] Tabulaten, p. 300.
[3] »Die Zoantharia perforata der Palæozoischen Periode» in »Nachrichten von der Kön. Gesellschaft der Wissenschaften zu Göttingen» 1866, p. 238, and in »Zeitschrift der deutschen Geol. Gesellschaft» 1866, p. 305, Taf. IV, fig. 2.
[4] Polyp. terr. palæoz., p. 143.
[5] Recherches sur les Polypiers. »Monographie des Poritides» in Ann. Sc. Nat., 3me Sér., vol. 16, p. 30.

a broken edge the sclerenchyma plainly consists of a solid, not spongy mass, and the microscopic structure in all probability coincides with that of Protaræa, as do also other specimens from Wesenberg. The columellar portion or the central area is more prominent in SEEBACH's specimen as it has been so much weathered all around. In consequence of what I now have stated, I think that Stylaræa Roemeri cannot be retained as an independant genus nor as a species and that it is rather to be regarded as a form of the highly variable Protaræa vetusta.

NICHOLSON described[1] a new genus of Silurian Corals under the name of Cleistopora (= more correctly Clistopora) and asserts that its affinities are with Protaræa. This cannot, however, be the case as it is composed of a porose, reticulated sclerenchyma without any distinct septa in the calicles.

Protaræa vetusta. J. HALL.

Pl. XII, figs. 19—24.

1847. Porites? vetustus J. HALL. Pal. N. York I, p. 71, pl. 25, figs. 5*a*, 5*b*.
1850. Astræopora vetusta D'ORB. Prodr. I, p. 25.
1851. Protaræa vetusta E. & H. Pol. Terr. Pal., p. 208, pl. 14, figs. 6, 6*a*.
1851. » » IID. Monographie des Poritides, Ann. Sc. Nat. Zool., 3me Sér., vol. 16, p. 47.
? 1856. Diplastræa diffluens EICHWALD. Bull. de Moscou, p. 111.
1860. » » ID. Lethæa rossica I, I, p. 445, pl. 30, fig. 11*a*, *b*, *c*.
1860. Protaræa vetusta E. & H. H. N. Cor. III, p. 185.
1866. » » VON SEEBACH. Zeitschr. d. deutsch. Geol. Gesellschaft, p. 305, Taf. IV, f. 1.
1866. Stylaræa Roemeri v. SEEBACH. Ibid., p. 306, Taf. IV, f. 2.
1873. Protaræa vetusta LINDSTRÖM. Sv. Und. Sil. Corall., p. 21.
1875. » » NICHOLSON. Geol. Survey Ohio, Palæontology 2, p. 221.
1878—81. » » QUENSTEDT. Petref. Deutschl., p. 54, pl. 145, f. 12, 13, p. 907, pl. 178, f. 37.
1878. » » NICHOLS. & ETH. Girvan, pl. 4, fig. 3, 3*a*.
1880. Stylaræa Roemeri LINDSTR. Fragm. Silurica, p. 31.
1881. » » QUENST. Petref. Deutschl., p. 908, pl. 178, fig. 40.
1882. Protaræa vetusta J. HALL. Indiana 11th Rept., p. 378, pl. 49, fig. 4.
1883. » » FERD. ROEM. Lethæa geogn., p. 456.
1883. Stylaræa Roemeri FERD. ROEM. Ib., p. 456.
1888. » » LINDSTR. List of Cambr. Sil. Fossils, p. 23.
1889. Protaræa vetusta LESLEY. Diction. Foss. of Pennsylv., vol. 2, p. 774.
1889. » » MILLER. Catalogue, p. 201, f. 209.
1895. » » WINCHELL and SCHUCHERT. Geol. of Minnesota, vol. III, pt. I, Palæontology, p. 94.
1896. » » SARDESON. Tabulaten, p. 300.
1897. » » var. magna. WHITEAVES. Palæoz. Foss. Canada, vol. III, pt. III, p. 155, pl. 18, figs. 2, 3, 3*a*.

This coral seems to have always grown on other fossils as a thin crust, seldom exceeding 2 millims in thickness. The fig. 21, pl. XII, represents the first foundations of a colony, which is highly deviating in its appearance from the mature form.

[1] Geological Mag. 1888, p. 150.

It consists only of a thin film, covered by a great number of rounded, glossy tubercles, confusedly arranged in squares as if to foreshadow the outlines of calicles and within them heaps of smaller tubercles in lines following the costæ and striæ on the surface of the subjacent shell.

The mature coral has circular calicles of 2 millims. in diameter constantly with twelve, comparatively thick septa, the crest of which is indented with a single row of tubercles. They leave a narrow area free in the centre, covered with a few blunt tubercles. Between the closely packed calicles there is very little space left for a coenenchyma, but a narrow surface covered with tubercles without any pores or tubuli may be indicated as a sort of coenenchyma.

The sclerenchyma is made up of the distinguishing large baculi of pinnate structure and there is not the least vestiges of tabulæ or dissepiment.

There is a sort of coenenchymal gemmation, as new calicles arise out of the surface between the calicles.

This is an exclusively Lower Silurian coral and the oldest known of this family as it is found in the strata of Wesenberg in Estland. But it also ranges higher to the Lyckholm beds of Estland, at Piersal and to the Leptæna Limestone of Dalecarlia. In North America it is very common in the Trenton limestone, in the Cincinnati group, in Ohio and at Richmond, Indiana.

Gen. *Acantholithus* n.

(Ἀκάνθα, spine.)

Corallum grown in thin lamellæ, several close above each other linked together on one side, each of the superior ones being in organic connection with the next inferior or growing from a corner of them. The inferior surface formed by a uncommonly thick epitheca of tubular structure. The superior surface with the calicles, which as a rule have short septa surrounding a central area, covered with numerous short papillæ, which are the heads of the columnar baculi. There are no tabulæ in the calicles, nor are these circumscribed by a well defined theca. The coenenchyma consists of very narrow tubuli, with thick walls of irregularly polygonal or circular shape. These walls show the same pinnate structure as the baculi. In some specimens there are tabulæ, concave, distantiated, but as a rule the walls have increased in thickness as to leave no place for the development of such. This genus which is chiefly Lower Silurian has affinities on the one side with Cosmiolithus through the finely reticulated coenenchyma and on the other hand, with the Coccoseridæ through the well developed baculi and the whole conformation of the calicles. There is a large material still to be found in the Lower Silurian strata of Estland, which, when collected, may clear up some obscure points in the structure of these beautiful corals, as yet difficult to explain.

Acantholithus lateseptatus n.

Pl. XII, figs. 23—30.

This coral has the form of a large, expanded lamella with undulating surface; it is very thin, only 5 millims. in thickness with a surface of the dimensions of 18 × 12 cm.

The basal or epithecal stratum is of uncommon shape and thickness. Instead of the usual, in a section scarcely perceptible film, there is here a well discernible tubular stratum. In the figures 29—30 it is seen below the other sclerenchyma. In the fig. 28 its lower surface is delineated with the apertures of the tiny tubes and in fig. 29 the upper surface, the stellate markings of which possibly may be derived from parasitic, boring organisms.

The calicles are regularly distributed over the superior surface of the coral with a mean distance of 2 millims., having themselves a diameter of a little more than one millimeter. The septa (fig. 23) are short, triangular, broad and covered with small warts. The central area is large, studded with small, rounded papillæ. The interior of the calicular tubes (fig. 29) is in the centre filled with baculi, on the sides of which there are concave tabulæ. In another section (f. 30) of the same specimen the tabulæ are wanting and only baculi are seen.

The coenenchyma is composed of closely set, minute, irregularly polygonal tubes, having in their aperture several short, blunt spines emanating from the interior side and on the crest of the walls also erect, warty prominences project. In a longitudinal section the walls have increased considerably in thickness and the tubes are divided in compartments by some few, distantiated, concave tabulæ. In another section of the same specimen (fig. 30) the baculi, of which the coenenchymal walls are constructed, have grown so as to form a uniform mass in which there is no vestige of any tube nor of tabulæ. It is very difficult to make these intrinsic structural differences to agree with each other. It may be that an excessive growth of the coenenchymal walls in some specimens entirely suppress the formation of tabulæ, leaving no place for these to develop.

A large and fine specimen, belonging to the Geological Survey of Sweden, has been found in a morainic accumulation at Kopparsvik near Wisby, probably like so many others, of Lower Silurian origin. In the Stockholm museum there is also a specimen found on the shore, Norderstrand, near Wisby. As stated on the next page a variety or mutation of this species, now in the University Museum of Breslau has been found at Sadewitz.

Acantholithus asteriscus. Ferd. Roem. p. p.

Pl. XI, figs. 31—35.

1858. Heliolites inordinata Fr. Schmidt p. p. Archiv, p. 226.
1861. Heliolites interstincta Ferd. Roemer. Sadewitz, p. 24, pl. IV, f. 4.
1880. Heliol. intricatus var. lamellosus, Lindstr. p. p. apud Angelin, Fragmenta Silurica, p. 32, tab. I, fig. 5.
1883. Hel. asteriscus Ferd. Roemer p. p. Lethæa geognostica, Abth. 1, Lief. 2, p. 505.

Corallum forming thin plates of about four millimeters in thicknes. The epitheca is free, unless where growing out from or being in continuation with an older colony as

often is the case. The *calicles* are sunk a little in the coenenchyma, the twelve septa narrow, tapering, reaching halfways to the centre; broadly bifurcated or forming a net at their basis. The theca which links them together is visible only as continuations from their bases and can not be discerned as an independant sceletal element further down in transverse sections. The septa form laminæ which have the same conformation of oblique baculi as in Coccoseris. The central area is covered by pointed papillæ, which in a longitudinal section are seen to be the tops of irregular or sinuous baculi completely filling the centre of the calicle.

The coenenchyma, as seen on the surface, is composed of narrow tubes, the walls of which are provided with small spines on the sides. These walls are relatively thick and increase in thickness lower down in the coenenchyma so as to entirely fill up the tubes (pl. XI, f. 33) and, as seen, are formed like large broad baculi.

It occurs in detached pieces along the shores near Wisby probably mostly derived from the oldest stratum of Gotland *a*. It has also been found *in situ* at Östbjörka in Dalecarlia in the whitish limestone with Leptæna Schmidti, thus from the top of the Lower Silurian. In Estland it seems to bee common in the corresponding strata F^1—F^2 at Worms, Hohenholm in Dagö, at Piersal from which places Academiker Fr. Schmidt kindly has sent me specimens named Heliolites inordinatus.

Through the kindness of Professor Fr. Frech I have been enabled to examine the original specimen of Ferd. Roemer's »Heliolites interstincta», which is preserved in the University Museum at Breslau. I have given a figure of a portion of its surface on pl. XI, fig. 35 and I have found that it in all particulars agrees with other specimens of this Acantholithus.

The Museum of Breslau also possesses six specimens of an Acantholithus from Sadewitz bearing the name Heliolites asteriscus F. Roemer. Of these three belong to the species above described, and are identical with the Gotland specimens as well as with the »Heliol. interstincta» just mentioned and preserved in the same museum and these all are consequently to bear the specific name »asteriscus» by which F. Roemer designated the identic Sadewitz fossils. Two other specimens belong to an Acantholithus which probably is to form a new species, and the sixth specimen is a variety of Acanthol. lateseptatus above described.

On plate XII, figs. 1—2 an underterminated specimen of an Acantholithus has been delineated. It has been found in a single fragment on the shore near Wisby, and is probably derived from the Arachnophyllum stratum *a*. It seems in a certain way to be intermediate between the two other species. It has grown in thin lamellæ, connected with each other, the uppermost with a thickness of 8 millimeters. The calicles nearly of one millimeter across. The *septa* are longer than in the two preceding species and the central area consequently not so wide nor the papillæ so numerous. The calicular tube shows in a longitudinal section on both sides the septa of the structure peculiar to the Coccoseridæ and the centre filled with the narrow contorted baculi. The coenenchymal tubes are distinct, with thick walls and continue downwards provided with distantiated concave tabulæ. The epitheca does not attain the thickness as in Acantholithus lateseptatus and is in a section seen as a finely serrated line.

Explanation of the Plates.

All figures have been drawn by Herr G. LILJEVALL, unless otherwise stated.
The numbers ($^6/_1$) mark the scale of the enlargement.
The plates are executed in Herr C. WESTPHAL's phototypic establishment.

Plate I.

Heliolites interstinctus L. p. 41.

Fig. 1. Surface of a specimen from the Arachnophyllum stratum near Wisby. $^6/_1$.
» 2. Longitudinal section of the same; tabulæ a little irregular, an irregular columella on two of the lowest of them. $^6/_1$.
» 3. Transverse section below the surface of a specimen from the Arachnophyllum beds. $^6/_1$.
» 4. Surface of a specimen with uncommonly small calicles, nat. size.
» 5—6. Transverse sections of the same below the surface, $^6/_1$; fig. 5 situated a little higher up than f. 6.
» 7. Longitudinal section of the same, calicular tube budding out of the coenenchyma.
» 8. Longitudinal section of another specimen, from the same stratum; near the top, in the middle of the calicular tube a streak of sectioned columellas is seen; then it is interrupted and a little higher a continuation appears; on the right side a narrow septal lamina is sectioned. $^6/_1$.
» 9. Surface of typical specimen from the stratum *d* near Wisby. $^8/_1$.
» 10. Surface of a specimen with columellas, stratum *d* near Wisby, nat. size.
» 11. A not fully mature calicle from the same specimen, magnified, showing how the septa, which still are long on the right side, have communicated with the central columella and probably originated it through their union and left it alone, when they have been reduced in size.
Fig. 12. Longitudinal section of a specimen from stratum *a* near Wisby, showing how the calicular tubes and the coenenchyma arise directly from the epitheca; vestiges of columellas a little higher; to observe is the peculiar wavy line formed by the theca. $^6/_1$.
» 13. Part of a specimen from the stratum *a* near Wisby, with a new calicle in the act of developing, the large septa discernible except in the lower right corner; in the centre there is still coenenchyma out of which the columella is formed later; the central line between the walls of the coenenchymal tubes clearly visible, and also in the septa. $^8/_1$.
» 14. Transverse section of a specimen with divided columella, small, partially absorbed septa. $^6/_1$.
» 15. Longitudinal section of a specimen from stratum *d*, near Wisby, showing how two long calicular tubes proceed from the coenenchyma; long columnar streaks in the middle; columella at times evidently divided or branching, origin of coenenchymal tubes through fission evident. $^4/_1$.
» 16. Surface of specimen from *a*, calicles with irregular septa, the left one had just been forming. $^6/_1$.
» 17. Specimen from the highest limestone beds of Bara hill, Gotland, as a type for the

youngest mutation of this species, the calicles of the largest; nat. size.

Fig. 18. Surface of a specimen from the Devonian beds of the »Alpi carniche», Italy, kindly communicated by Dr G. DE ANGELIS D'OSSAT in Rome. $^4/_1$.

» 19. Surface, nat. size, of a large polypary from the stratum *d* near Wisby, with narrow tubular calicles, large columella and convex tabulæ.

» 20. The same, magnified $^6/_1$, columella twisted and branching, the lowest calicle at the right partly overgrown by coenenchyma.

» 21. Two calicles from the same specimen as in figures 19—20, being invaded and overgrown by coenenchyma; the columella is still visible in the left one. $^6/_1$.

» 22. Longitudinal section of the same specimen, showing a peculiar manner of growth; a new polypary having extended sideways and caused the extinction of the older subjacent by covering it. In the large calicinal tube at the left side, in the centre a broad columella has been sectioned, showing a cuspidate crest. At the top of the same tube may be seen a curious accumulation of densely packed tabulæ, a phenomenon also observed in other sections, probably due to an abnormous or pathological secretion, causing the destruction of the polyp. $^6/_1$.

» 23. Another section of the same, showing irreguliarities in growth through the condensation of the tabulæ. The dark oblique lines below are caused by accidental cracks, causing a partial displacement of the tubes. Columellar streaks and besides small aculæ on the tabulæ. Thecæ of the calicinal tubes sinuous. $^6/_1$.

» 24. Transverse section lower down. The calicles have the »decipiens» facies. The shaded parts of the tubes are due to the horizontal tabulæ of the coenenchyma being sectioned. $^6/_1$.

Fig. 25, 26, 27. Three different, incipient polyparies affixed to brachiopoda. Coenenchyma scanty on the lower side of primary polypierite. All from the stratum *d* of Wisby. $^8/_1$.

» 28. Longitudinal section of another incipient polypary $^8/_1$. Same locality. The coenenchyma has begun on the right side of the first polypierite and the second calicle has budded from it.

» 29. Longitudinal section of a calicle, from the stratum *d*, to show incipient or broken tabulæ forming a sort of septal grooves at their point of contact with the septa. $^8/_1$.

» 30. Transverse section of a primary polypierite, one millimeter above its apex, showing three small septa on the right side, traces of tabulæ; no coenenchyma. $^8/_1$.

» 31. Longitudinal section of a small polypary, showing the irregular manner of overgrowing older polypierites. Initial polypierite to the right. In the larger central calicinal tube there is a series of three longitudinal, interrupted streaks, fragments of septa, as the tube has been cut near the theca, not centrally. $^6/_1$.

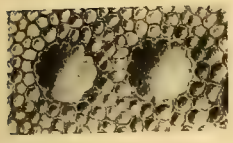
» 32. A series of sections I—IV from the same calicle showing its gradual development out of the coenenchyma beginning at I. Section II contains two stages. $^{10}/_1$.

» 33. Longitudinal section of another calicle, same specimen to show how the coenenchyma is broken up when the gemmation sets in. $^{10}/_1$.

» 34. A series of sections I—IV to show the intracalicinal gemmation, beginning at I. $^8/_1$.

» 35. Two instances of intra-calycinal gemmation; in the left one a new calicle has grown out of the coenenchyma of the older. $^8/_1$.

» 36. Section, longitudinal of a calicinal tube, being overgrown with ceenenchyma. There is in the middle a curious funnel on the lower side of which five small globular bodies are fixed, and two below which seem to have fallen down on the uppermost tabula. Parasites? Ova? $^{10}/_1$.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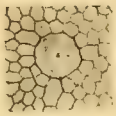
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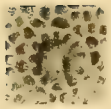
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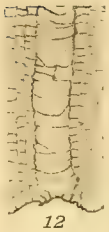
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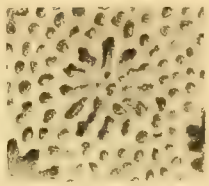
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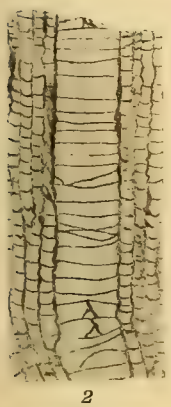
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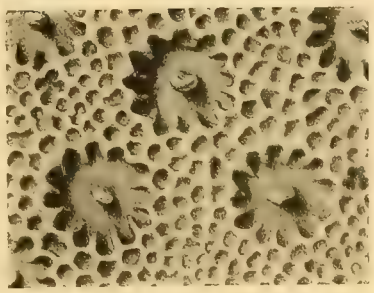
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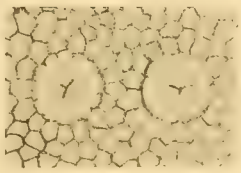
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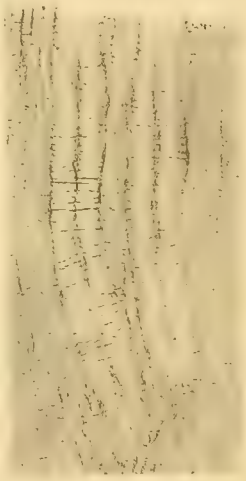
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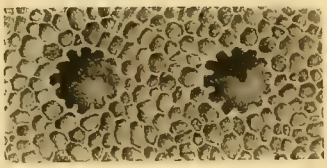
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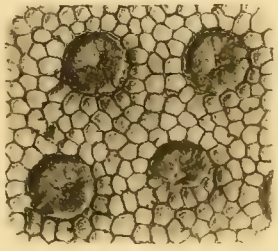
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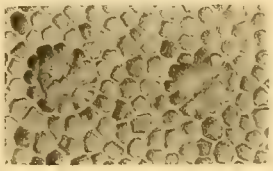
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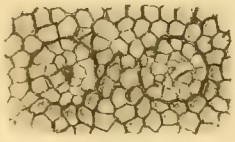
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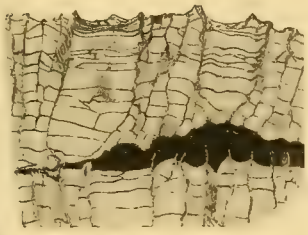
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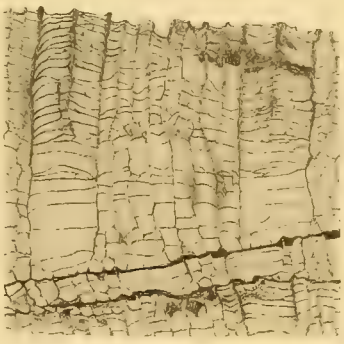
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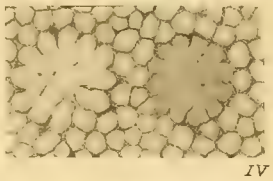
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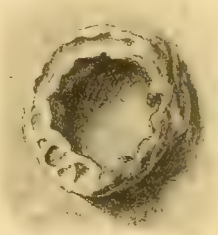
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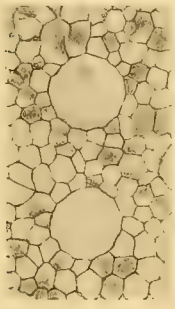
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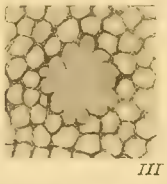
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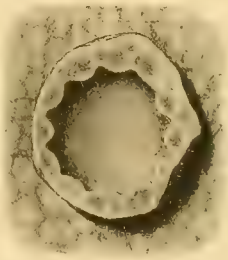
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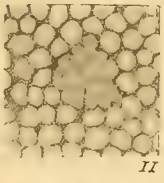
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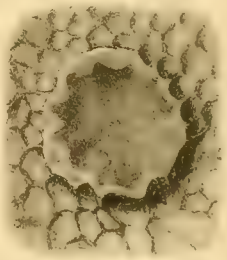
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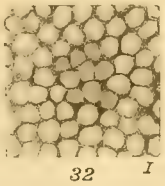
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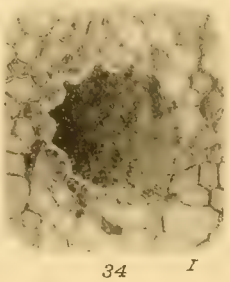
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Plate II.

Heliolites interstinctus L. p. 41.

Fig. 1. Transverse section of a variety from the uppermost limestone of Gotland (Tjelders Boge). The black dots in the centre are sections of the vertical rods. $^{8}/_{1}$.

» 2. Longitudinal section of the same showing a number of vertical rods on the tabulæ, probably residues from the coenenchymal thecæ out of which the calicular tube has through gemmation been developed. The microscopic fibrillæ of the septal and thecal lamellæ are seen at left in the left tube. $^{8}/_{1}$.

Heliolites interstinctus-decipiens p. 48.

Fig. 3, 4, 5, 6. Four calicles, that have grown on the surface of the same polypary. F. 3 youngest with not fully developed septa, f. 4 with twelve long septa nearly as Hel. porosus, f. 5 like the regular Hel. interstinctus, f. 6 the common typical »decipiens» without any septa and like all other calicles of the same polypary, excepting the three first mentioned. $^{6}/_{1}$.

» 7, 8. Transversal and longitudinal sections of a variety from the Arachnophyllum stratum near Wisby. $^{6}/_{1}$. Concave tabulæ.

9, 10. Sections of another specimen, same locality, quite circular calicles without the least indication of indentures. $^{6}/_{1}$.

11. Surface, nat. size, of a variety from Petesvik, every calicular tube is raised on a little elevation of the coenenchyma so as to be thereby separated from its neighbours.

» 12, 13. Sections of the same. The regularly circular calicles are environed by regular coenenchymal tubes, of which some 13—14 are regularly placed like an aureola around the calicle. In the longitudinal section is seen how the calicular tube arrises directly out of the coenenchyma. $^{6}/_{1}$.

Fig. 14. Surface, nat. size, of specimen from Wisby, stratum *d*, with the large calicles osculating and raised above the coenenchyma.

15. The same enlarged. $^{6}/_{1}$.

16. Var. bohemicus from Kozel in Bohemia. $^{6}/_{1}$.

17. Another specimen of the same, large calicles, nat. size.

18, 19. Sections of n:o 17, approaching to interstinctus. $^{6}/_{1}$.

20. Specimen from Büchel bei Paffrath Cöln, like a decipiens. $^{8}/_{1}$.

21. Cast of Mac Coy's type specimen for his figure of Fistulipora decipiens pl. I, *C*, fig. 1, »British Palæozoic Fossils», now preserved in the Woodwardian Museum, University of Cambridge, England, natural size.

22. Part of the same enlarged. $^{8}/_{1}$.

Favosites (*Fistulipora*) *canadensis* Billings p. 49.

Fig. 23. Surface of specimen from Widder, Canada, nat. size, presented by Mr. Billings.

» 24. Enlargement of the same. $^{6}/_{1}$.

» 25. Part of the interior showing oscula (pores) and broken tabulæ. $^{10}/_{1}$.

Fig. 26. Another specimen, same locality, being more highly silicified.

27. Surface of the same, one large calicle environed by smaller. $^{6}/_{2}$.

Favosites sp.

Fig. 28. Surface, nat. size, to compare with Fav. canadensis. Up. Sil. From Gotland.

Heliolites porosus Goldfuss p. 53.

Fig. 29. Typical specimen, with alternating septa, as of two cycles. $^{10}/_{1}$.

30. 31. Other specimens with longer septa, f. 31 probably not of final shape, $^{10}/_{1}$; f. 29—31 from Eifel.

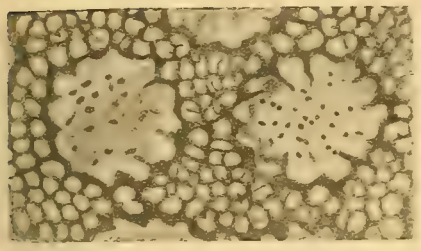
32. Specimen from Torquay, Devonshire, England, with very short septa, nearly resembling Hel. interstinctus, from which it however is distinct through the thickened theca. $^{10}/_{1}$.

33, 34. Transverse sections of calicular wall and coenenchymal tubes to show the microscopic structure with fibrillæ. $^{36}/_{1}$.

35. Showing the same in longitudinal section, to the right a part of a calicular tube, to the left a coenenchymal tube. The septal lamella is seen to stretch farther in the calicle and is fainter shaded. The tabulæ are on both sides incrusted by a growth of minute crystals and the clear interspaces are filled with calcareous spar. $^{36}/_{1}$. Specimens fromEifel.

Fig. 36. Longitudinal section of a calicular tube with five septal lamellæ having serrated edges, probably bases of spines, some fragments of tabulæ visible. Specimen from Kerpen—Nollenbach, Eifel. $^{10}/_{1}$.

37 I—VII. Two series of opposite changes in the coenenchyma. To the right coenenchymal gemmation is shown, to the left calicinal degeneration or a calicle slowly changing into coenenchyma. Fig. VII represents the fresh surface of the corallum and the other figures were obtained by cautiously abrading the coenenchyma with a knife. $^{10}/_{1}$. Both close beside each other on the same specimen.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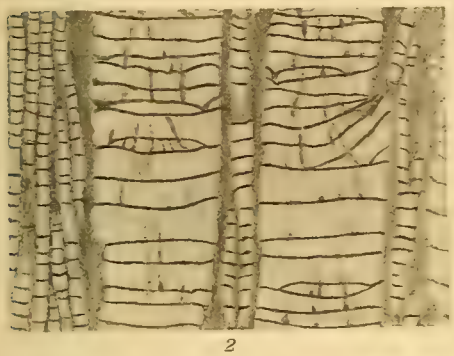
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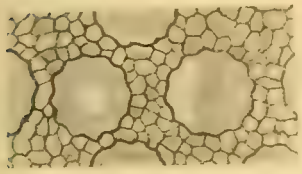
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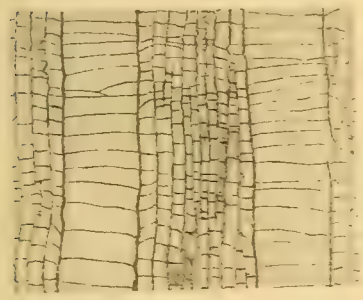
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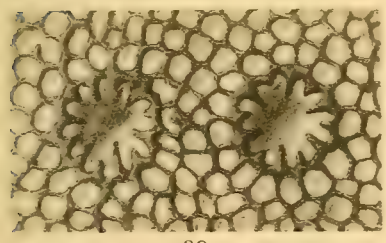
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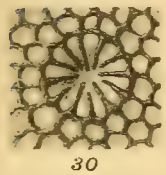
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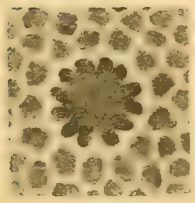
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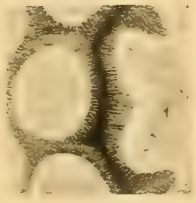
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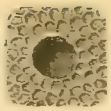
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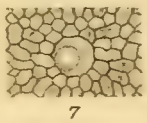
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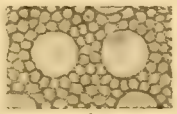
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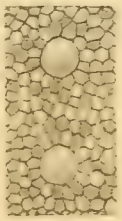
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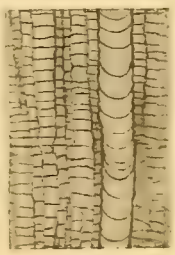
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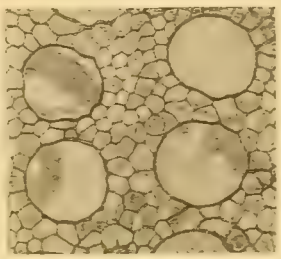
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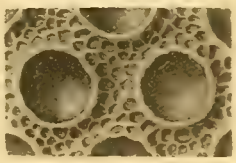
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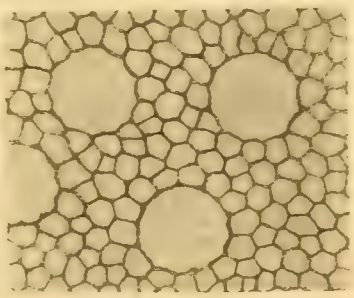
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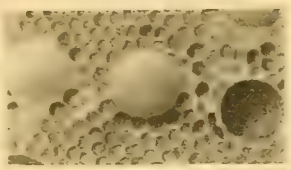
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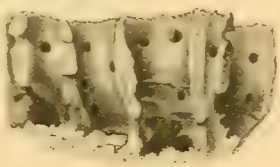
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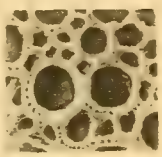
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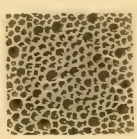
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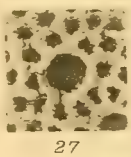
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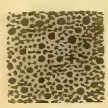
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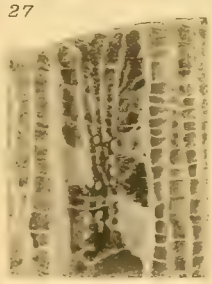
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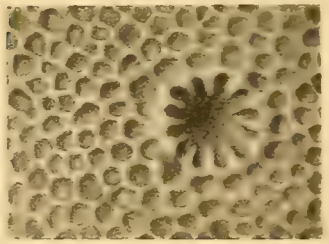
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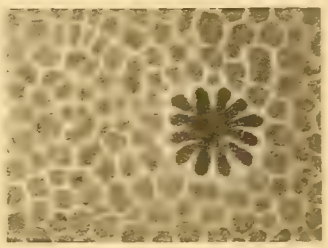
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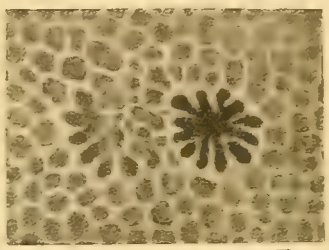
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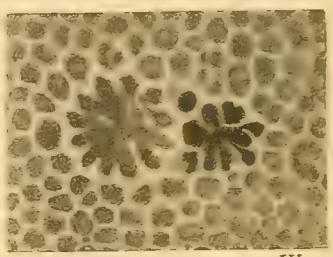
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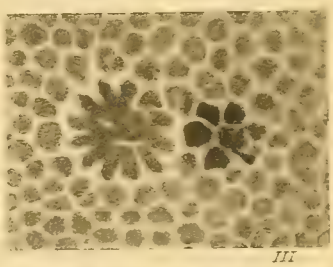
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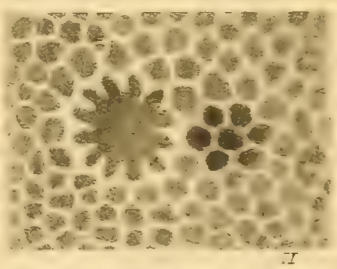
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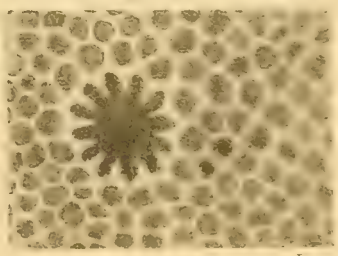
37 I

Plate III.

Heliolites interstinctus L. p. 41.

Fig. 1, 2. Microscopical structure in vertical and horizontal sections of a specimen from Tjelders, Boge, Gotland. $^{36}/_{1}$. In the centre a coenenchymal tube.

Heliolites porosus GOLDF. p. 53.

Fig. 3. A calicle beginning to change to coenenchyma. $^{10}/_{1}$.
» 4. The appearance of the same a little below, with normal structure. $^{10}/_{1}$.
» 5, 6. Three calicles from the same polypary, with different structure. Torquay, England. $^{10}/_{1}$.
Fig. 7. Longitudinal section of a calicular tube from the same polypary as the next previous. $^{10}/_{1}$. To remark the delicate spines of the septal margins and the thick thecæ in the coenenchymal tubes.

Heliolites Barrandei PENECKE p. 58.

Fig. 8. Part of the surface of a specimen from the Arachnophyllum stratum, *a* near Wisby; nat. size.
» 9, 10. Calicles of the same, as seen on the surface. $^{12}/_{1}$. Tops of inferior septal spines protruding in the centre.
Fig. 11. Transverse section of a calicle and coenenchyma. $^{12}/_{1}$.
» 12. Longitudinal section of the same. $^{12}/_{1}$.

var. *spongodes* p. 60.

Fig. 13. A polypary in natural size. Stratum *b—c* Wisby region. Drawn by C. HEDELIN.
» 14. A calicle of the same from the surface. $^{12}/_{1}$.
» 15. Transverse section of the same. $^{12}/_{1}$.
Fig. 16. Longitudinal section; to be observed are the ends of the septal spines in the centre of the calicle. Observe the different coloration in the vertical and the horizontal sclerenchyma. $^{12}/_{1}$.

Heliolites Barrandei PENECKE p. 58.

Fig. 17. Calicle from the surface, from stratum *d* Wisby. $^{12}/_{1}$.
» 18. Longitudinal section of the same. $^{12}/_{1}$.
» 19. Transverse section of larger variety from Lilla Carlsö, stratum *f*. $^{12}/_{1}$.
» 20. Longitudinal section of the same $^{12}/_{1}$. The white patches on both sides of the calicular tube are fragments of coenenchymal thecæ parallel with the sectioned surface.
Fig. 21. Part of the surface of a specimen from Tjelders, Boge, Gotland, nat. size.
» 22. Transverse section of a calicle of the same. $^{12}/_{1}$.

Fig. 23. Part of the coenenchyma to show the intimate structure of the walls of the thecæ. A portion of a calicle is visible on the left side. $^{24}/_{1}$.

» 24. Transverse section of the coenenchyma of a specimen from the Devonian of Graz, Austria, kindly sent from Dr PENECKE. $^{12}/_{1}$.

» 25. Longitudinal section of the same. $^{12}/_{1}$.

Fig. 26. Longitudinal section of coenenchyma from the same specimen as in fig. 18, to show how the tabulæ are on both sides covered with crystalline growth, the tabulæ looking white between.

» 27, I—IV. A series of sections showing the coenenchymal gemmation. $^{10}/_{1}$. Development beginning at section I. Distance between I and IV the fraction af a millimeter.

Heliolites parvistella FERD. ROEMER p. 60.

Fig. 28. Part of the surface of the original specimen of ROEMER, belonging to the Geological Museum of the University of Breslau, communicated by Prof. FRECH, found at Sadewitz in Schlesien. $^{12}/_{1}$.

» 29. Longitudinal section of the same. $^{12}/_{1}$. Original in the Museum of Breslau. The brackets in this and several of the following figures are intended to indicate the width of the calicular tube, as it is difficult to distinguish it from the coenenchyma.

Fig. 30. Transverse section of a specimen from Pattakumäggi, Isle of Oesel, Upp. Sil. $^{12}/_{1}$. Part of a specimen in the Museum of Reval.

» 31. Longitudinal section of the same. $^{12}/_{1}$.

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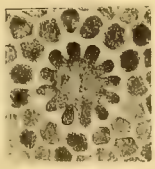
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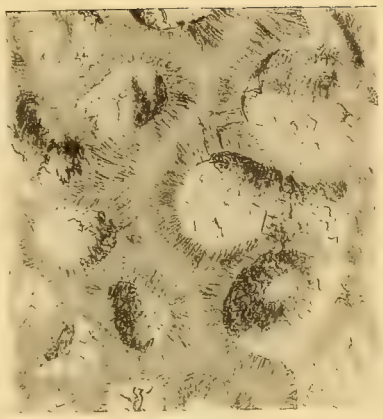
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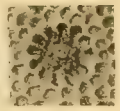
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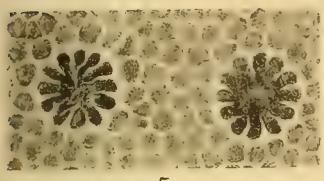
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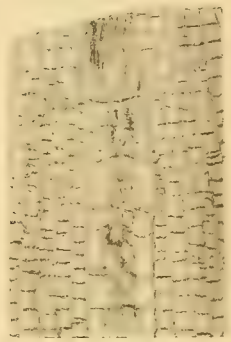
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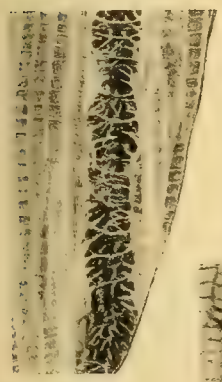
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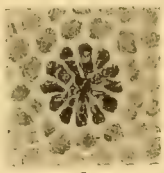
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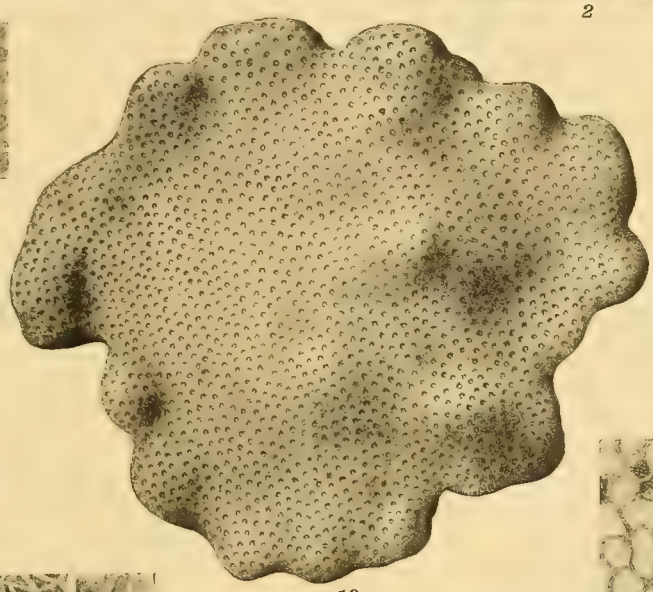
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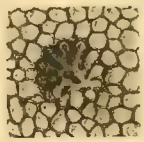
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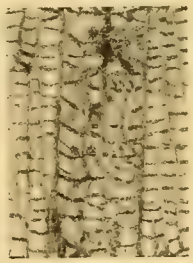
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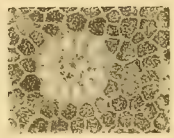
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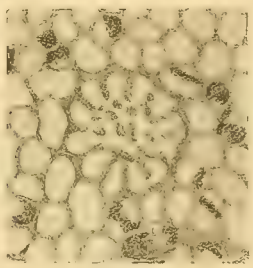
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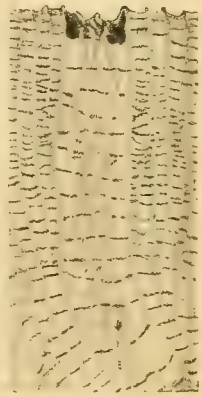
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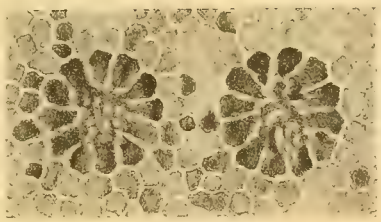
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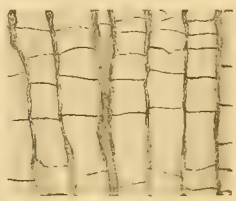
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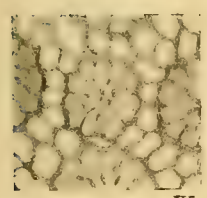
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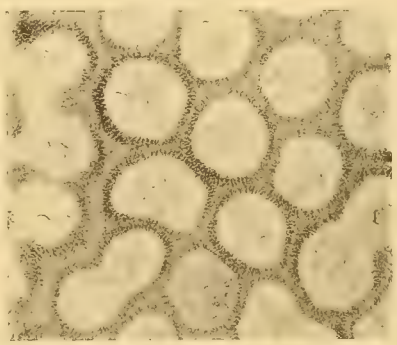
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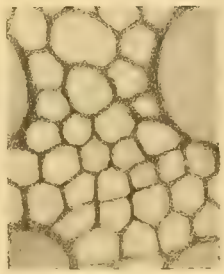
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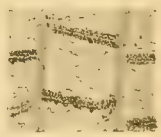
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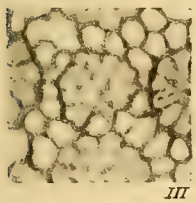
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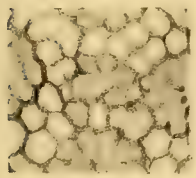
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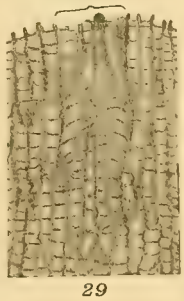
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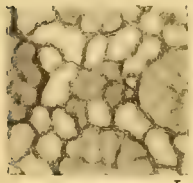
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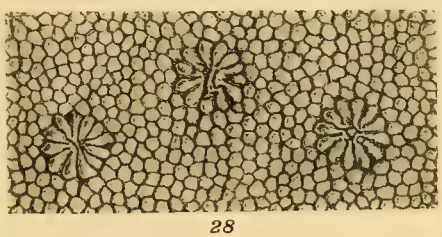
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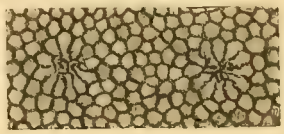
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Plate IV.

Heliolites Barrandei PEN. var. p. 60.

Fig. 1. Arborescent variety from Sandarfve kulle, Gotland, limestone bed *f*, nat. size.

Heliolites parvistella FERD. ROEMER p. 60.

Fig. 2. From the surface of a specimen from Louisville, N. Amer. $^{8}/_{1}$.
» 3. Longitudinal section of the same. $^{8}/_{1}$.
» 4. Part of surface, nat. size of specimen from Kozel, Bohemia, also called Stelliporella lamellata WENTZEL.
» 5. Transversal section of the same a little below the surface. $^{6}/_{1}$.
» 6. Longitudinal section of the same. $^{6}/_{1}$.
» 7. Part of surface of a specimen from the islet Stora Carlsö near Gotland, nat. size.
» 8. The same magnified. $^{10}/_{1}$.
» 9. Longitudinal section of the same. $^{10}/_{1}$.

Heliolites parvistella, var. *intricata* n. p. 63.

Fig. 10. Specimen in natural size from the stratum *c* at Djupvik, Eksta, Gotland. Drawn by C. HEDELIN. $^{8}/_{1}$.
» 11. Portion of the surface with calicles *in statu nascenti*.
» 12. A calicle, fully developed, from the same. $^{8}/_{1}$.
» 13, 14. Transverse sections at different levels from the same specimen, Djupvik, Eksta. $^{8}/_{1}$.
» 15. Portion of the surface as instance of the intracalicular gemmation originating three different polyparia. $^{8}/_{1}$.
» 16. Longitudinal section of a specimen from Djupvik, Eksta. $^{8}/_{1}$.
» 17, 18. Transversal sections of a specimen from the islet Lilla Carlsö, difference in level 1 mm., fig. 17 being the uppermost one. $^{8}/_{1}$.
» 19. From the base of the same specimen showing coenenchymal gemmation. $^{8}/_{1}$.

Heliolites fasciatus n. p. 65.

Fig. 20. Surface in nat. size from the stratum *a* near Wisby.
» 21. A calicle from the same. $^{12}/_{1}$.
» 22. Longitudinal section showing the characteristic banded structure, eight or nine fasciæ seen above each other. Cylindrical tubes of a parasite sectioned. $^{3}/_{1}$.
» 23. A portion of the coenenchyma longitudinally sectioned with a fascia. $^{12}/_{1}$.
» 24. Longitudinal section. $^{12}/_{1}$.
» 25. Transversal section of coenenchyma between the fasciæ. $^{12}/_{1}$.

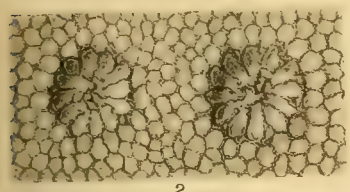
Heliolites repletus n. p. 65.

Fig. 26. The surface in natural size, specimen from the shale beds *b* near Wisby.
» 27. Calicles *in statu nascenti* from the surface. $^{8}/_{1}$.

Fig. 28. A more developed calicle surrounded by irregular thickened coenenchyma of the fasciate nature. $^{8}/_{1}$.
» 29. A fully developed calicle with regular coenenchyma. $^{8}/_{1}$.
Fig. 30. Longitudinal section. $^{8}/_{1}$.
» 31. Transversal section, calicles with absorbed septa. $^{8}/_{1}$.

Heliolites Liljevalli n. p. 66.

Fig. 32. Natural size of calicles and coenenchyma.
» 33. Transverse section. $^{12}/_{1}$.
Fig. 34. Longitudinal section. $^{12}/_{1}$.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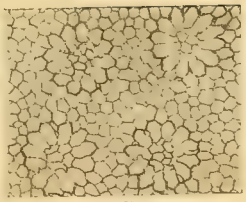
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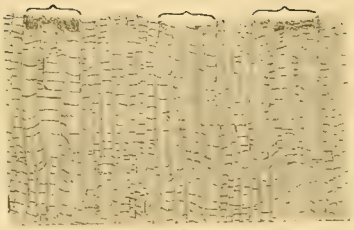
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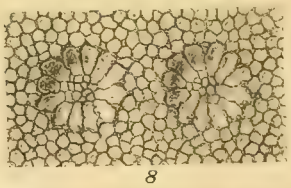
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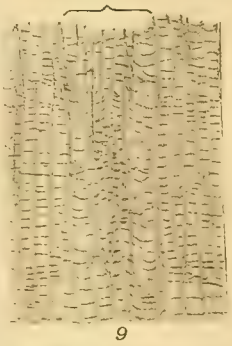
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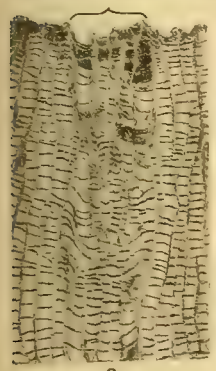
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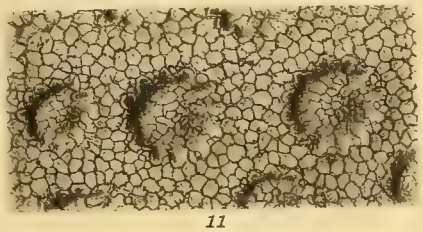
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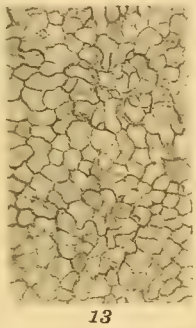
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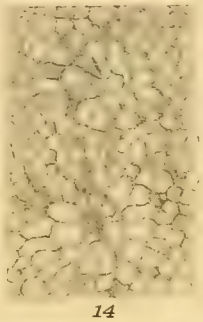
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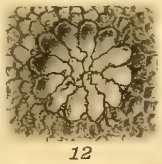
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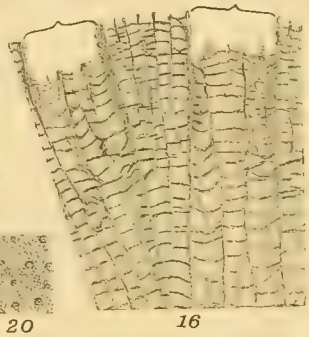
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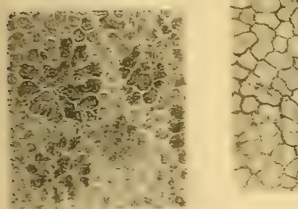
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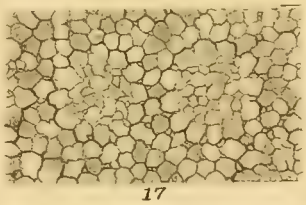
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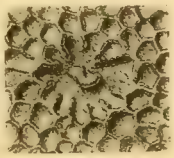
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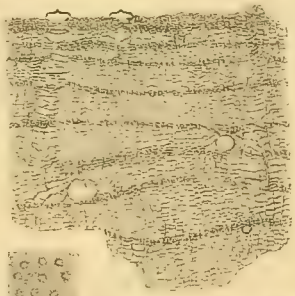
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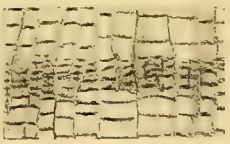
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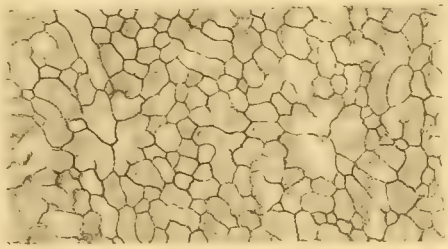
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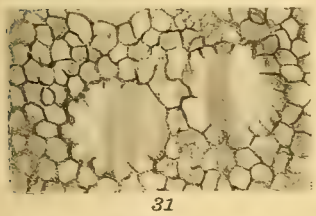
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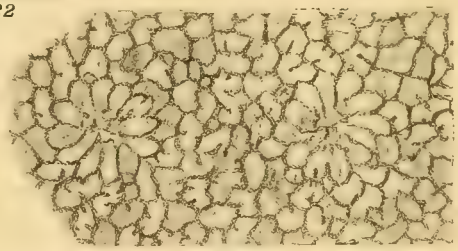
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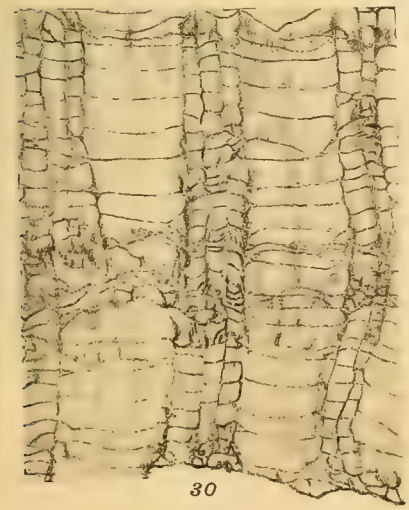
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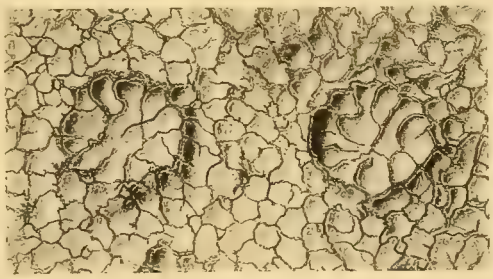
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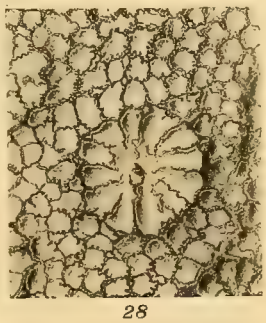
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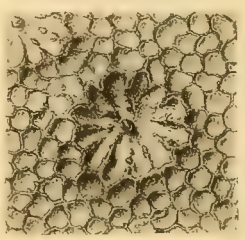
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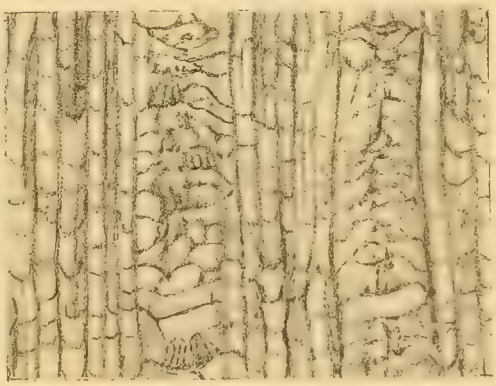
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Plate V.

Heliolites repletus n. p. 65.

Fig. 1, 2. Transverse sections to show the altered coenenchyma when there is a fascia formed. Especially in fig. 2 it is much modified with thick walled tubes having a false appearance as if provided with septa. I do not feel quite sure whether this much deviating structure may not be due to the intrusion of a semi-parasitic Favositoid colony. Both from the lowest strata *b* near Wisby. $^{8}/_{1}$.

Heliolites parvistella var. *intricata* n. p. 63.

Fig. 3. Some incipient calicles to show their development out of the coenenchyma. From Djupvik in Ekста. $^{8}/_{1}$.

Cosmiolithus ornatus n. p. 68.

Fig. 4. Transverse section of a specimen from the Arachnophyllum shale *a* near Wisby. $^{12}/_{1}$.
» 5. Longitudinal section of the same. $^{12}/_{1}$.
6. Part of the surface, natur. size of a specimen, same locality.
7. The same magnified. $^{12}/_{1}$.
Fig. 8. Surface of another specimen, nat. size; same locality.
» 9. Transverse section of the same. $^{12}/_{1}$.
» 10. Longitudinal section of the same. $^{12}/_{1}$.
» 11. Longitudinal section of a specimen with more slender walls, from Klinte. $^{12}/_{1}$.

Cosmiolithus halysitoides n. p. 69.

Fig. 12. Part of the surface of specimen from Wisby, stratum *a*.
» 13. The same magnified. $^{12}/_{1}$.
» 14. Longitudinal section of the same. $^{12}/_{1}$.
» 15. Surface of another specimen, magnified. $^{12}/_{1}$.
Fig. 16. Longitudinal section of the same. $^{12}/_{1}$. Irregular lacunæ in the septal laminæ not structural.
» 17. Transverse section deeper down of a third specimen from stratum *a*. $^{12}/_{1}$. Coenenchymal thecæ tightened.
» 18. Longitudinal section of the same. $^{12}/_{1}$.

Plasmopora stella n. p. 83.

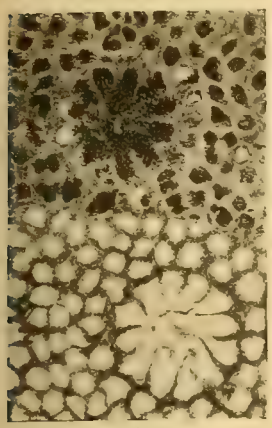
Fig. 19. Part of the surface, specimen from the stratum *a* Wisby. $^{4}/_{1}$.
» 20. Transverse section of the same. $^{6}/_{1}$.
21. Longitudinal section of the same. $^{6}/_{1}$.
22. Transverse section of another specimen, same locality, $^{6}/_{1}$; with small projections like costæ on the outside of the theca.
Fig. 23. Transverse section of a specimen from Kattentack, Estland. $^{6}/_{1}$.
» 24. Longitudinal section of the same. $^{6}/_{1}$.
» 25, 26. Sections of a specimen from the stratum *a* near Wisby.

Plasmopora scala n. p. 84.

Fig. 27, 28. Sections of a specimen from the stratum *a* near Wisby. $^{6}/_{1}$.

Plasmopora stella n. p. 83.

Fig. 29, I—VII. A series of transverse sections to demonstrate the coenenchymal gemmation. $^{6}/_{1}$.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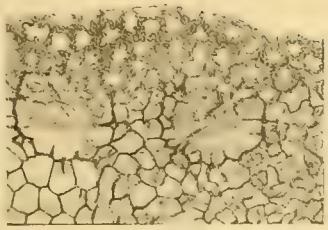
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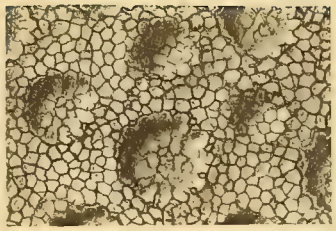
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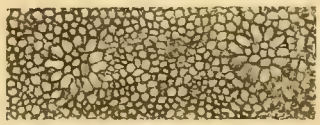
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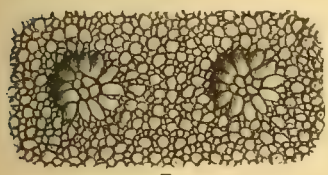
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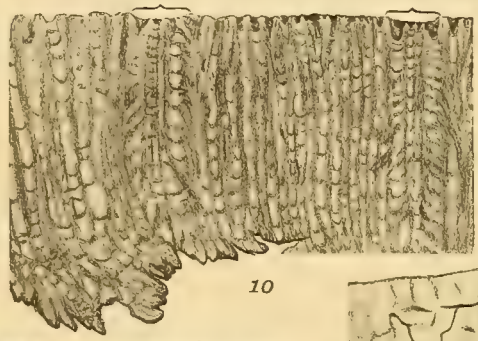
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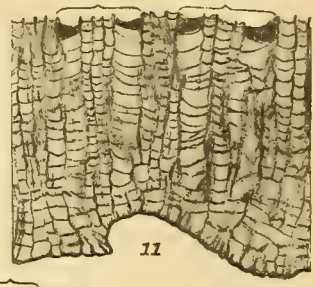
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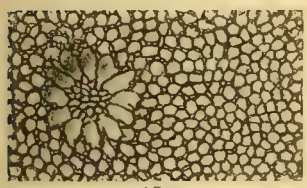
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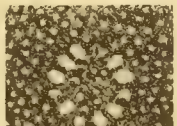
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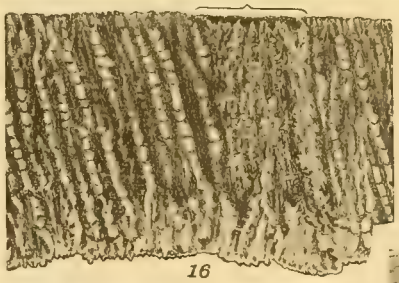
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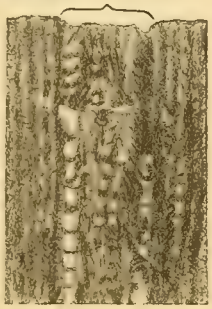
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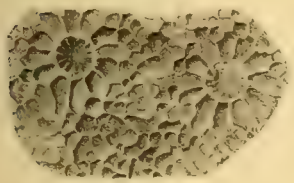
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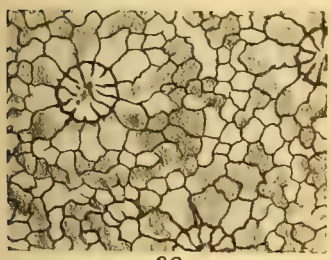
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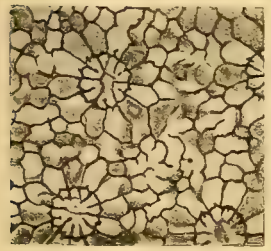
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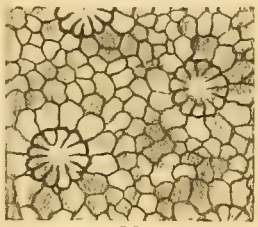
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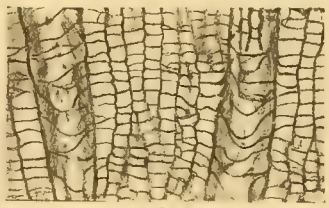
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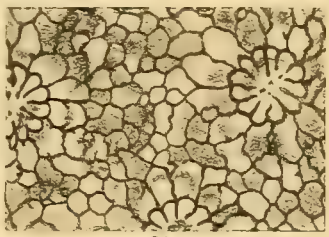
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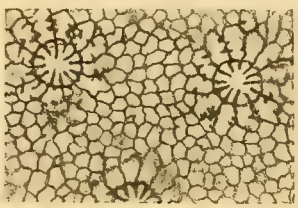
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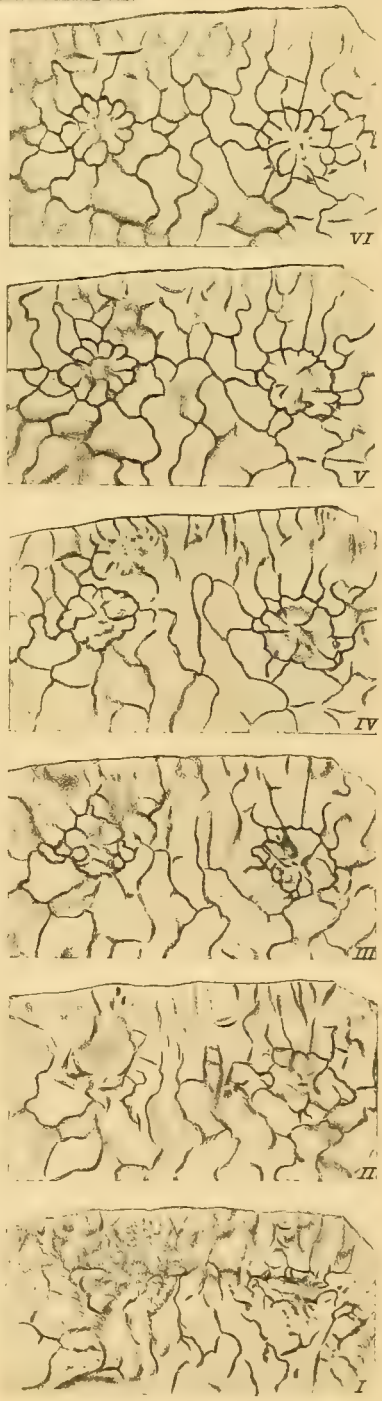

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Plate VI.

Plasmopora petaliformis Lonsdale p. 77.

Fig. 1—5. Transverse and longitudinal sections of two different specimens from Dudley, England. $^6/_1$. Fig. 3 is the basal part of figs. 1 & 2. Fig. 5 shows to the right how the structure prevalent in the coenenchyma of fig. 2 originates from the aculæ. The septa, especially in fig. 4, partially destroyed and absorbed.

6. Surface, nat. size, of a specimen from Stora Carlsö.

Fig. 7. Portion of the same magnified. $^6/_1$.

» 8, 9. Sections of the same. $^6/_1$. Observe in fig. 9, central coenenchyma, aculæ placed in longitudinal rows and at last forming bacilli.

» 10—12. Sections of a specimen also from Stora Carlsö. $^6/_1$. The shaded, vertically streaked patches in figs. 11 & 12 probably walls or thecæ of coenenchymal tubuli, the section going alongside these.

Plasmopora, variety of *P. petaliformis* p. 78.

Fig. 13. The surface magnified. $^6/_1$. From Tjelders in Boge, Gotland.

Fig. 14, 15. Sections of the same. The dotted lines in the right calicular tube are rows of septal spines seen *en face*. $^6/_1$.

Plasmopora foroensis n. p. 78.

Fig. 16. Surface, magnified, $^6/_1$, of a specimen from Tjelders in Boge, Gotland, irregularly grown.

» 17. Surface, magnified $^6/_1$, of a typical specimen from Ryssnäs, Fårö.

» 18—20. Sections of a specimen from the same locality. $^6/_1$.

Fig. 21. Longitudinal section of a specimen from Slite. $^6/_1$.

» 22. A similar of a specimen from Slite, Lännaberget. $^6/_1$.

Plasmopora calyculata Ldm. p. 79.

Fig. 23. Typical specimen from Norderstrand, Wisby, nat. size.

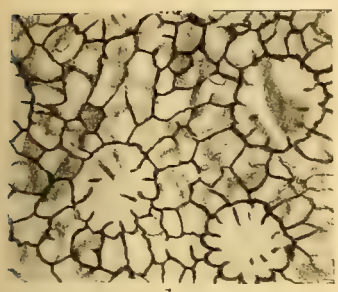
» 24. Portion of the same, magnified. $^6/_1$.

25. A bud from the surface of the same, rudimentary theca and septa. $^6/_1$.

Fig. 26. Section a little below the surface, showing the dissimilarity with section (f. 27) taken lower down.

» 27—29. Sections of specimen from Wisby, stratum *b*. $^6/_1$.

30. Longitudinal section of a specimen from Dudley, England. $^6/_1$.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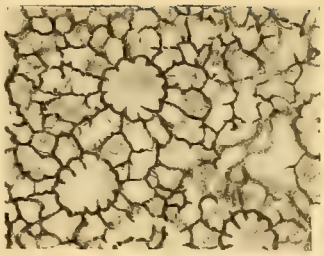
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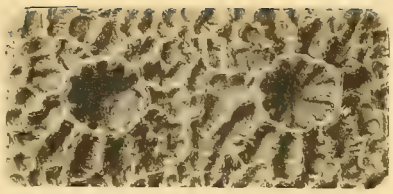
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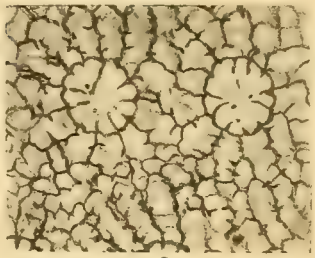
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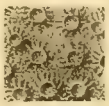
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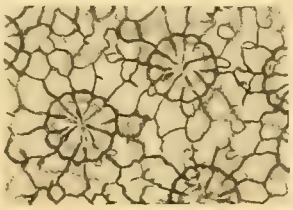
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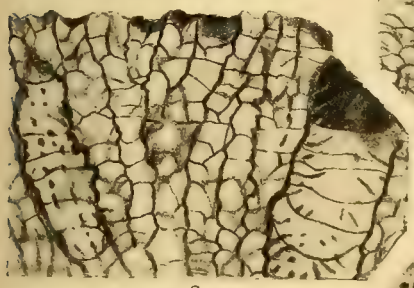
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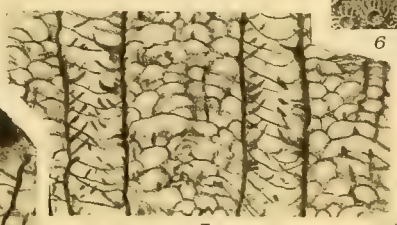
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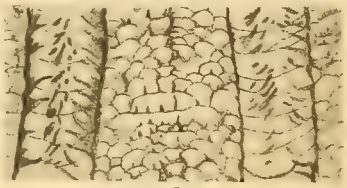
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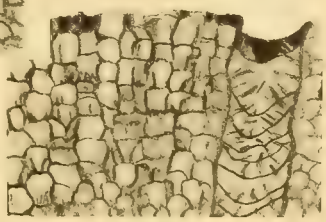
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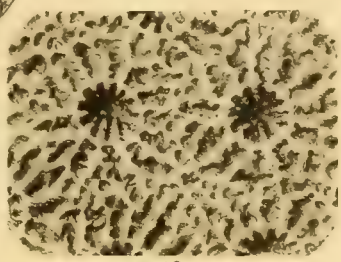
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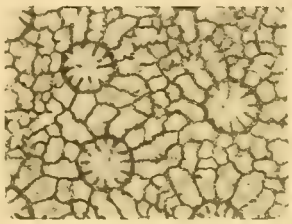
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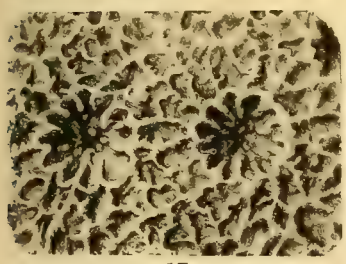
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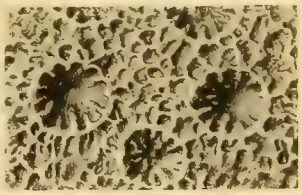
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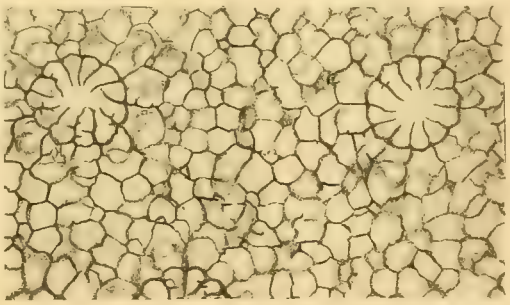
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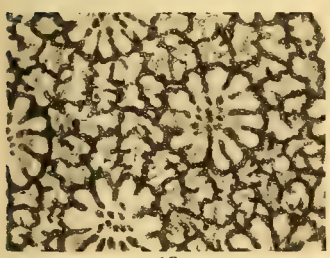
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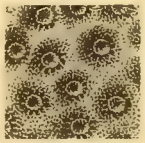
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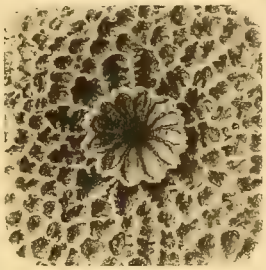
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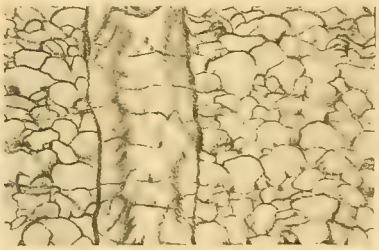
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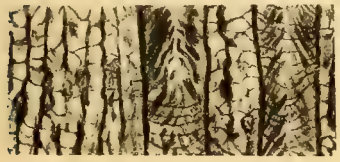
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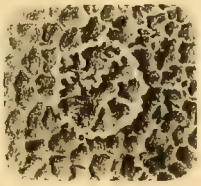
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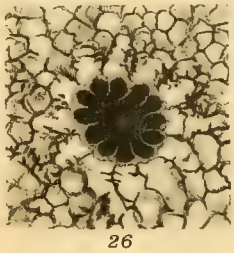
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Plate VII.

Plasmopora forvensis n. p. 78.

Fig. 1 (I—IV). Series of coenenchymal gemmation.

Plasmopora calyculata var. *tuberosa* p. 80.

Fig. 2. A polypary, natural size, from the stratum *d* near Wisby. Drawn by C. HEDELIN.
» 3. A calicle magnified. $^6/_1$.
Fig. 4, 5. Sections of the corall. In the middle of the longitudinal section of the calicular tube the margins of three septa are seen.

Plasmopora scita EDW. & H. p. 81.

Fig. 6. Surface of a polypary from Stora Carlsö. $^6/_1$.
» 7, 8. Sections of specimen from Lilla Carlsö. $^6/_1$.
9, 10. Sections of specimens from Djupvik, Eksta. $^6/_1$. To remark the transitions from aculæ to bacilli.
11. Sections of lower portion of specimen from Stora Carlsö, showing a different coenenchyma, which higher up in the same specimen resembles the previous. $^6/_1$.
Fig. 12, 13. Sections of specimen from Wisby, stratum *d*. $^6/_1$. The central calicular tube in fig. 13 cut near the theca. $^6/_1$.
» 14, 15. Another specimen from Wisby, stratum *d*.
» 16. Surface of specimen from Wisby showing a variety of calicles which occurs with normal ones on the same specimen. $^6/_1$.
» 17, 18. Sections of the same, showing normal structure. $^6/_1$.

Plasmopora follis EDW. & H. p. 82.

Fig. 19, 20. Sections of a specimen from Perryville, Cincinnati. $^6/_1$.

Plasmopora rosa n. p. 84.

Fig. 21. Transverse section of specimen from Linde klint. $^6/_1$.
Fig. 22, 23. Longitudinal sections of the same. $^6/_1$.

Plasmopora suprema n. p. 85.

Fig. 24. Surface of specimen from Linde klint. $^6/_1$.
Fig. 25, 26. Sections of the same. $^6/_1$.

Plasmopora rudis n. p. 85.

Fig. 27, 28. Sections of specimen from Sandarfve kulle. $^{8}/_{1}$.

» 29, 30. Sections of specimen, typical, from Helvi. $^{6}/_{1}$.

Fig. 31. Portion of interior calicular wall, showing the rounded septal lists covered with minute granules and crossed by fragments of the tabulæ. $^{6}/_{1}$.

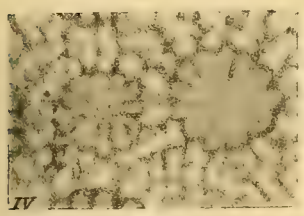
Plasmopora heliolitoides n. p. 86.

Fig. 32, 33. Sections of specimens from Östergarn. $^{6}/_{1}$.

Plasmopora? reticulata n. p. 87.

Fig. 34. Part of the surface, nat. size, specimen from the Arachnophyllum stratum of Wisby.

Fig. 35, 36. Sections of the same. $^{6}/_{1}$.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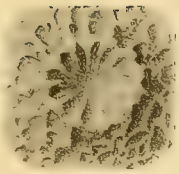
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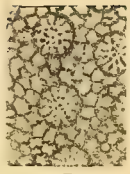
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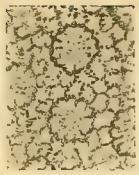
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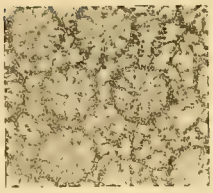
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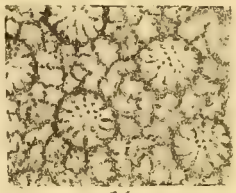
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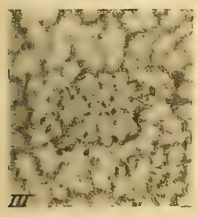
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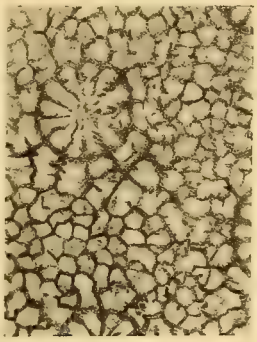
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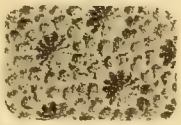
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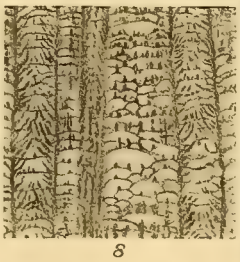
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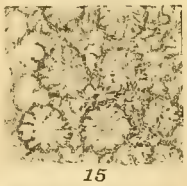
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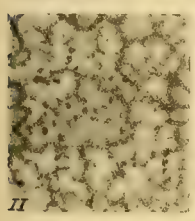
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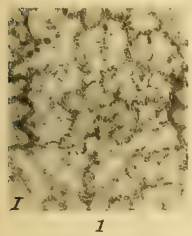
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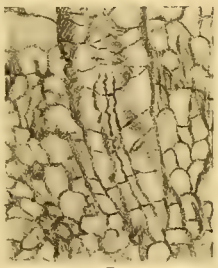
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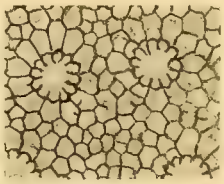
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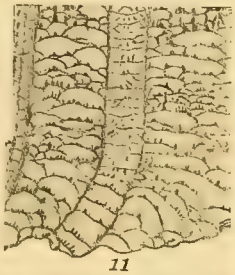
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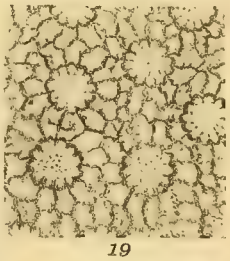
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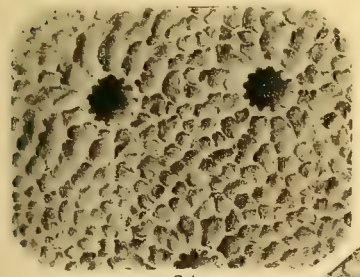
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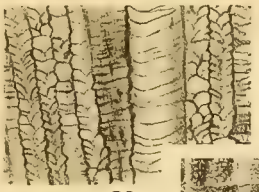
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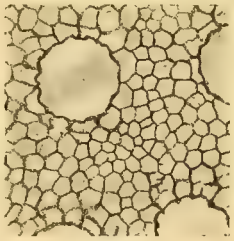
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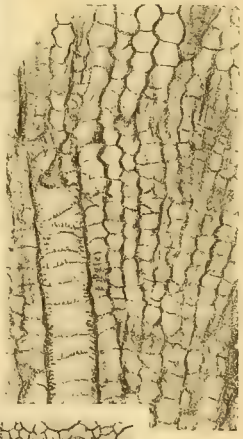
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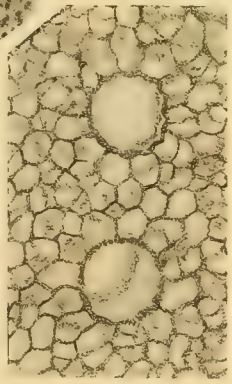
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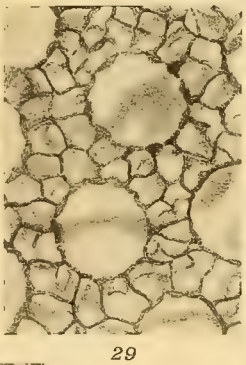
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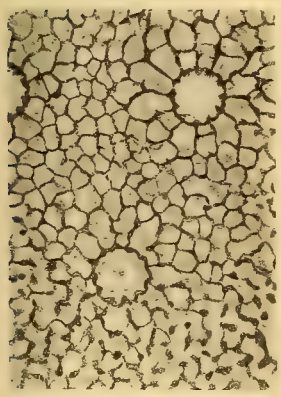
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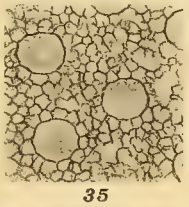
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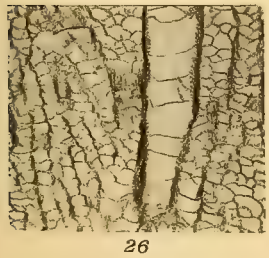
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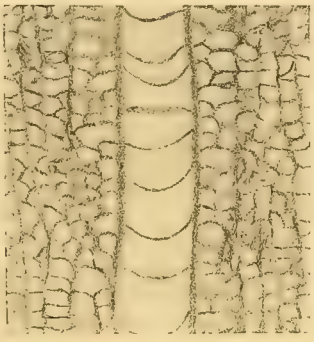
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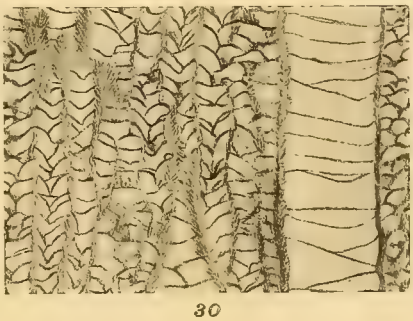
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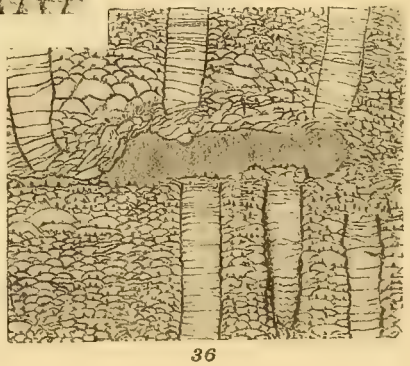
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Plate VIII.

Plasmopora scita Edw. & H. p. 81.

Fig. 1, 2. Aspects of different calicles to be compared with figs. 6 & 16 on plate VII showing the gradual transition of calicle fig. 6 through 1 and 2 to fig. 16, pl. VII, magnified. $^6/_1$.

Fig. 3. Calicle of a variety of Pl. scita. $^6/_1$.

It is to be observed that the communications with the coenenchyma in the margin of the calicle exist only on the surface of the coral.

Propora tubulata Lonsdale p. 89.

Fig. 4—7. Surface and sections of a specimen from Dudley, England. Fig. 4 typical form with calicles resembling those in Milne Edward's figures, $^5/_1$. Figs. 5—7 magnified, $^6/_1$. Fig. 7 basal part of fig. 6 showing epithecal gemmation.

» 8. Surface of a specimen from Gotland, Wisby; stratum *d*, the costal radii replaced by convex laminæ of the same kind which constitute the vesicular tissue of the interior; they are covered with minute warts, or aculæ probably of the same sort seen in the interior on the top of the convex laminæ. $^5/_1$.

» 9, 10. Sections of the same specimen. In f. 9 between the calicles the convex laminæ sectioned.

» 11. Surface showing a variety approaching to that in fig. 8 the concave laminæ nearly all effaced and the surface of the coenenchyma granulated. From Wisby *d*. $^5/_1$.

Fig. 12, 13. Sections of the same, the longitudinal one showing great similarity with that of Plasm. scita. $^5/_1$.

» 14, 15. Sections of another specimen from Wisby. $^5/_1$.

» 16, 17. Sections of a specimen from Oesel, Undwa, belonging to the Geological Survey of Sweden. $^4/_1$.

» 18, 19. Sections of a specimen from Borkholm, Estland, Lower Silurian, stratum F^1. Older variety with distantiated calicles and more compact vecicular tissue. $^4/_1$.

» 20. Surface, nat. size, of same specimen as in figs. 16, 17.

» 21. Surface, nat. size, of specimen 18, 19.

» 22. Ditto of specimen from the Arachnophyllum stratum *a* of Wisby same variety as in figs. 18, 19.

Propora euryacantha n. p. 92.

Fig. 23. Calicle showing the flat triangular septal spines, specimen from Fårö, Gotland. $^6/_1$.

Propora tubulata, var. p. 91.

Fig. 24, 25. Sections of specimen, called Lyellia americana Edw. & H., from Point Detour, Michigan, to be compared with fig. 10 & 15.

Propora euryacantha n.

Fig. 26, 27. Sections of specimen from Fårö, of another specimen than in fig. 23. Fig. 26 near the surface.

Propora tubulata Lonsd. p. 89.

Fig. 28. Showing calicinal gemmation, a young colony on an old polypary. $^6/_1$. Eksta, Gotland.

29—31. Sections of specimen called »Lyellia parvituba» Rominger from Louisville, Kentucky, Niagara group. It is a variety of Pr. tubulata, compare figs. 9 & 10 or 14 & 15. In fig. 29 the calicles are completely filled with adventitious crystals of later growth, of which so great masses are seen in the calicular tubes and also around on the convex laminæ of the coenenchyma. $^6/_1$. In the section, fig. 31, the frequent breaks in the continuity of the calicular tubes are also to be observed, caused by the exuberant growth of the coenenchyma.

Propora conferta Edw. & H. p. 93.

Fig. 32. Transverse section of the original specimen, preserved in the Collection Verneuil in the Musée de l'École des Mines» in Paris. From Borkholm in Estland, stratum F^1. $^1/_1$.

» 33. Calicles a little more enlarged, same specimen, to show the curious aspect of the septa, crystals having grown in tufts on their extremities.

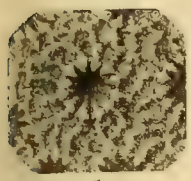
» 34. Longitudinal section of the same specimen. $^1/_1$.

» 35. Part of a calicle of specimen from Borkholm in Estland, highly magnified, $^{12}/_1$; to show the deformation of the septal ends, being covered by cristals of arragonite.

Fig. 36. Surface of specimen, nat. size, from Walve ref, Gotland found detached, and of the same structure as the specimen of Milne Edward's. The aculæ on the tabulæ in this and other specimens are not indisputably organic, but rather cristals of minerals.

» 37. Surface of the second of Milne Edward's original specimens, in École des Mines, from »Chavli» in Estland, nat. size.

» 38, 39. Sections of the same. $^4/_1$.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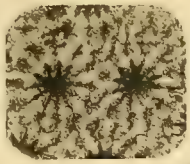
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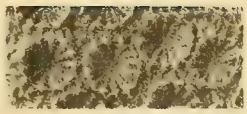
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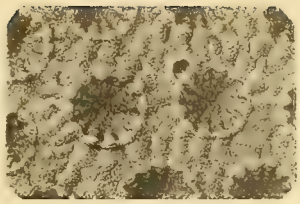
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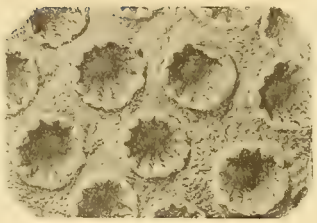
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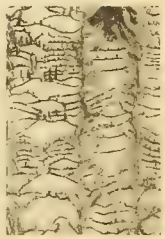
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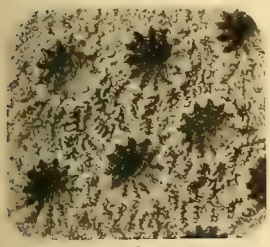
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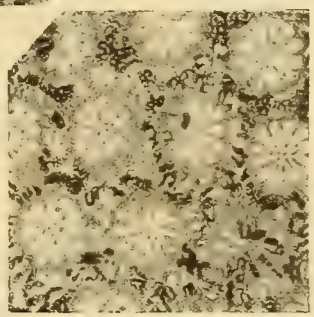
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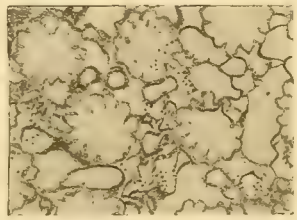
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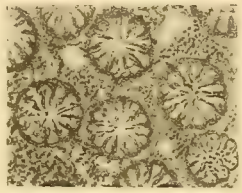
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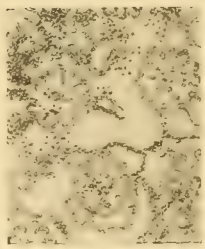
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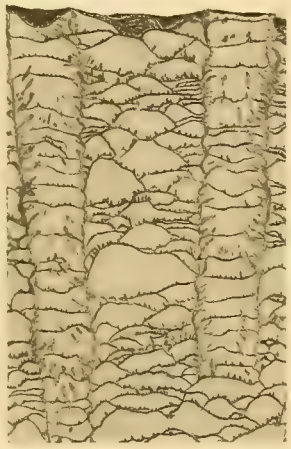
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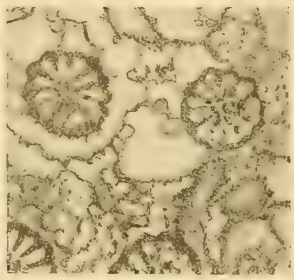
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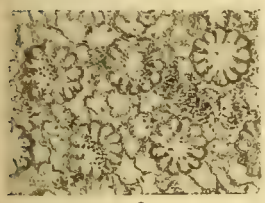
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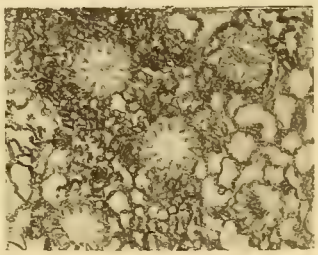
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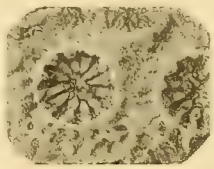
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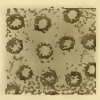
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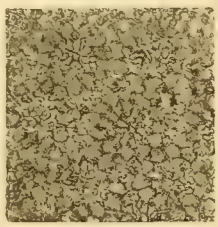
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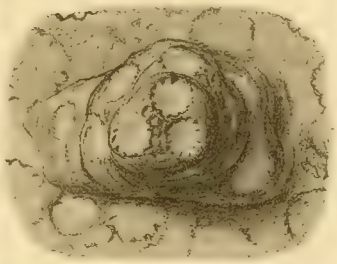
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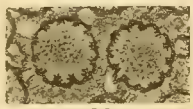
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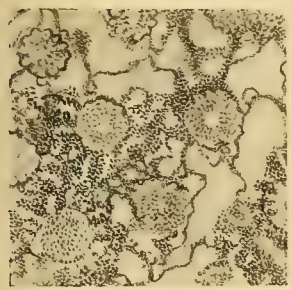
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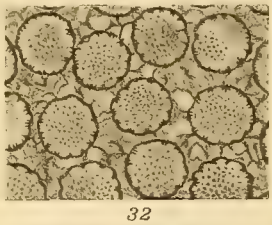
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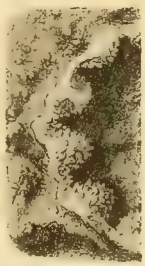
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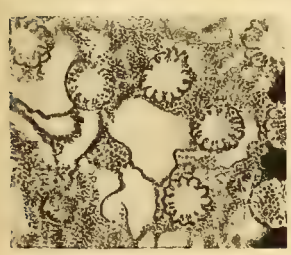
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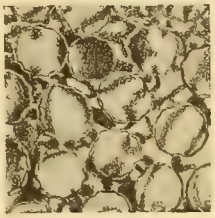
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Plate IX.

Propora conferta Edw. & H. p. 93.

Fig. 1, 2. Sections of specimen from Borkholm, Estland. 4/1. The fine needles visible on the interior walls of the calicles and on the tabulæ are inorganic or crystals.
» 3. Microscopic structure of calicinal thecas. Specimen from Piersal (F^1) Estland. 12/1. The composition of the thecæ and septa of fibrillæ is plainly visible. The Favositoid structures in the centres of some calicles possibly of parasitic nature.
» 4. Fragment of a calicle in longitudinal section, same specimen. 4/1. A pair of septal ridges between which the tabulæ form a sort of septal groove, as indicated by the concave lines.
5, 6. Sections of a variety from Tsiën-shui in China. 6/1. In fig. 6 partial destruction of calicinal theca through coenenchyma. No apertures in the theca to be assumed.
Fig. 7, 8. Ditto of a specimen from the middle Tunguska, Siberia. 6/1.
» 9, 10. Ditto of a variety with uncommonly thick walls from Ålleberg, Westrogothia. 4/1.
» 11, 12. Sections of a specimen from Anticosti, Canada, from type specimen of Billing's Heliolites affinis. 4/1.
» 13. Surface of the same in nat. size.
» 14, 15. A variety from Klef in Sundre, Gotland, 14 nat. size, 15 a calicle magnified. 6/1.
» 16. Part of the surface of a specimen from Dalecarlia, Sweden, nat. size.
» 17, 18. Sections of a specimen from Arfvet in Dalecarlia, Sweden. 4/1,
» 19. Part of the surface of the same nat. size.
» 20. Ditto, specimen from Östbjörka, Dalecarlia.
» 21, 22. Sections of the same. 4/1.
» 23. Longitudinal section, 4/1, of a specimen found detached in a canal at Wall, Gotland.

Propora conferta var. *minima* p. 95.

Fig. 24, 25. Sections of a specimen from the Arachnophyllum-beds near Wisby. 4/1.
Fig. 26. Part of the surface in nat. size.

Propora cancellata n. p. 95.

Fig. 27. Part of the surface, nat. size, from Borkholm, Estland.
» 28. Transverse section. 4/1.
Fig. 29. Part of the surface magnified. 4/1.
» 30. Longitudinal section of the same. 4/1.

Propora conferta var. p. 94.

Fig. 31. The corall in nat. size, from the Arachnophyllum stratum near Wisby.
Fig. 32. Natural longitudinal section of the same. 4/1.
» 35. Transverse section. 8/1.

Propora sp. indet. p. 98.

Fig. 33. Part of the surface, natur. size, Alfvaret, west of Hulterstad, Öland.
Fig. 34. A longitudinal section, effected through weathering. 2/1.

Propora (*Pinacopora*) *girvanensis* NICHOLS. & ETHERIDGE p. 99.

Fig. 36. Surface of a specimen from the Junction Cliff, Anticosti, Canada. $^5/_1$.

Fig. 37—39. Various sections of the same. $^5/_1$.

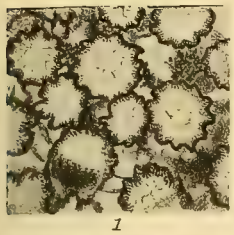
Propora speciosa BILLINGS p. 95.

Fig. 40. Part of the surface of a specimen from Anticosti, Canada. $^4/_1$.

» 41, 42. Sections of the same. $^4/_1$.

Fig. 43, 44. Sections of a specimen from Dudley, England. $^4/_1$. Septa much transformed.

» 45, 46. Sections of a specimen from Borenshult, Ostrogothia, Sweden. $^4/_1$.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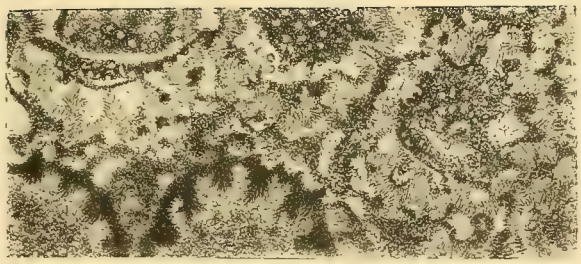
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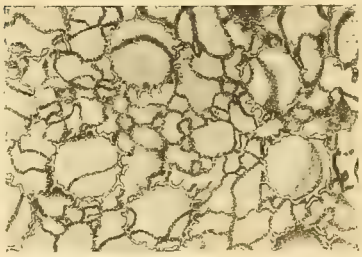
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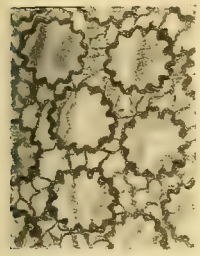
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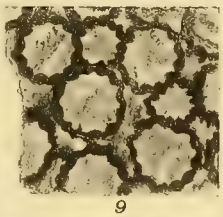
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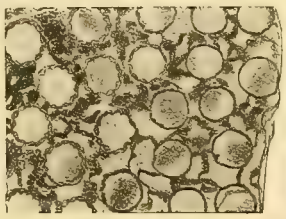
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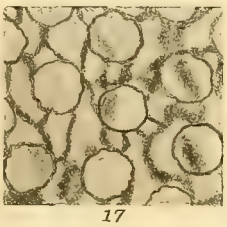
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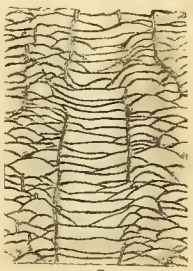
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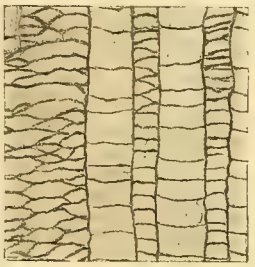
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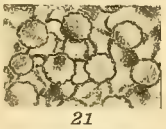
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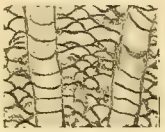
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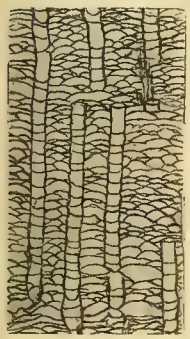
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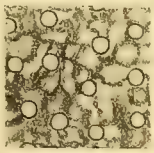
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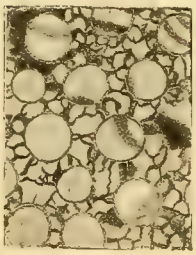
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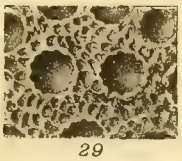
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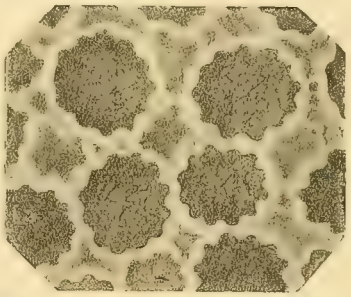
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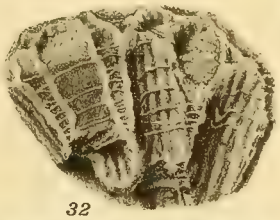
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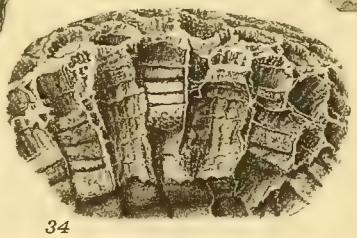
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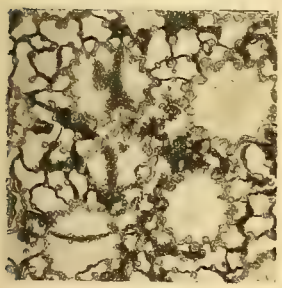
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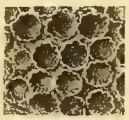
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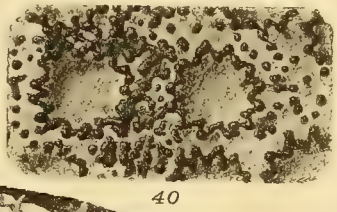
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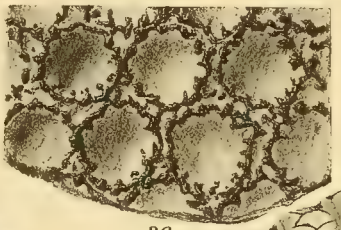
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Plate X.

Propora speciosa Bill. p. 95.

Fig. 1, 2. Transverse sections of specimens from Borenshult. $^{4}/_{1}$.

Fig. 3. Surface of a variety or mutation from Bara backe, Gotland. $^{6}/_{1}$.

» 4, 5. Sections of the same.

Propora compacta n. p. 96.

Fig. 6, 7. Sections of a specimen from Olenek, Sibiria. $^{6}/_{1}$.

Propora bacillifera n. p. 97.

Fig. 8—10. Sections of a specimen from Dalecarlia. $^{4}/_{1}$.

» 11. Surface of the same, nat. size.

» 12. Surface of another specimen, same locality, nat. size.

» 13. Surface of a specimen, nat. size, from Öland.

» 14, 15. Sections of the same. $^{3}/_{1}$. In fig. 15 in a lacuna at the left side of the section a little oval fossil is seen, possibly a Saccammina.

Fig. 16—18. Sections of specimen from Borkholm, Estland. $^{4}/_{1}$.

» 19, 20. Sections of specimen, from Piersal, Estland. $^{4}/_{1}$.

» 21. Surface of the same, nat. size.

Propora? ambigua n. p. 98.

Fig. 22, 23. Sections of specimen from the stratum *a* Wisby. $^{4}/_{1}$.

Fig. 24. Surface of the same, nat. size.

To observe the irregular growth of the coenenchymal lamellæ and how they have disturbed the development of the calicles. At the base no calicles visible, possibly directed the other way.

Camptolithus papillatus Rominger p. 101.

Fig. 25—27. Transverse sections of various specimens from Point Detour, Michigan, Am. $^{6}/_{1}$.

Fig. 28—30. Longitudinal sections of specimens, same locality. $^{6}/_{1}$.

Diploëpora Grayi Edw. & H. p. 102.

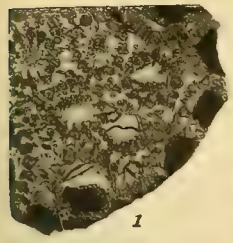
Fig. 31. A branchlet, nat. size, from Wisby.

» 32—35. Views of the surface to show the changes by growth fig. 32 being the oldest or first stage from the tip of a branch, fig. 35 the youngest, from Ryssnäs, isle of Färö, Gotland, f. 32—34 from the uppermost strata *f*—*h* near Wisby. $^{10}/_{1}$.

Fig. 36. Part of the surface of fig. 35, nat. size.

» 37, 38. Transverse sections of a mature specimen (as fig. 35) f. 38 deeper down than f. 37 which shows the densely packed baculi around the twelve baculi of the calicle, all with their fibrillæ. $^{10}/_{1}$.

As to the growth of the theca in the genus Propora I may here remark that in several species changes occur in a manner somewhat similar to what happens in Diploëpora. The initial sharpedged circular margins assume the shape of a ring of small beads, which form the bases of trabeculæ (baculi), out of which, twelve in number, by and by, the theca is made up in the later stage of growth. These trabeculæ of the common fibrillous structure lie close against each other and as may be seen from weathered specimens where the calicular tubes stand free, they form a compact theca, although it is very thin between the baculi. Sometimes there is seen as long, narrow slits in the theca, but this may be due to disintegration through pression or later changes. In plate XI, fig. 2 there is perhaps a side view of a wall with its trabeculæ. It is remarkable that in the oldest Proporæ as P. conferta and bacillifera this structure of the theca is not so prominent as in the Upper Silurian ones.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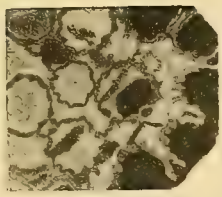
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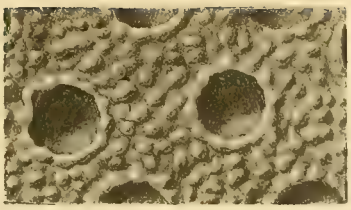
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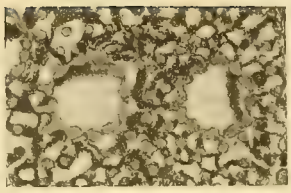
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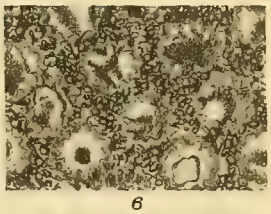
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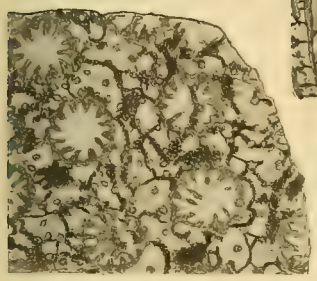
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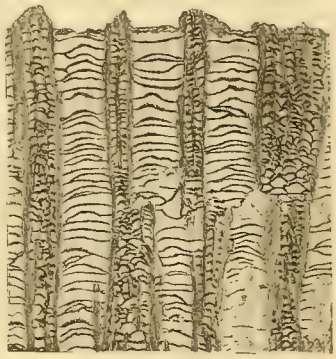
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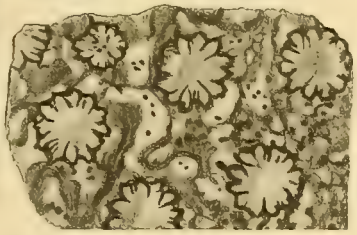
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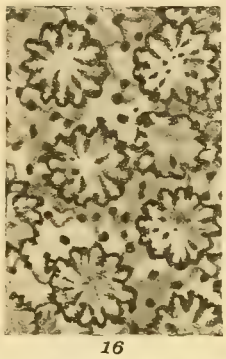
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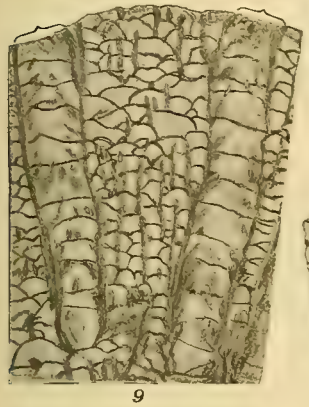
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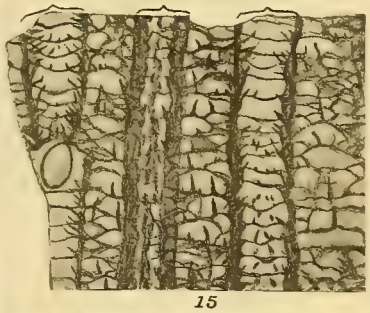
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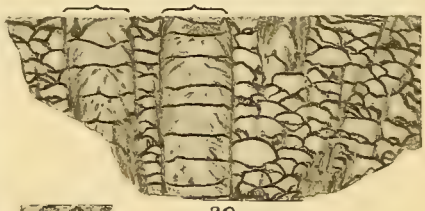
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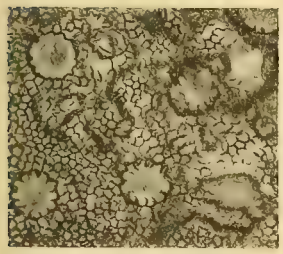
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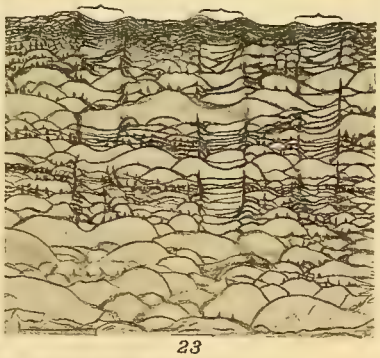
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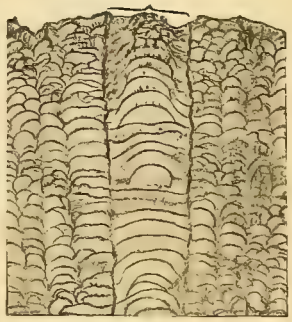
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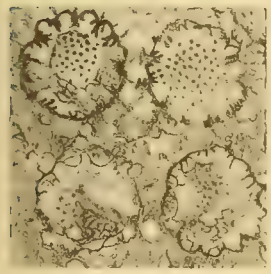
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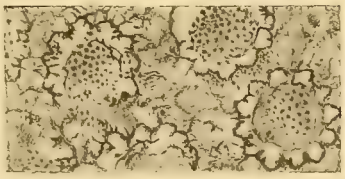
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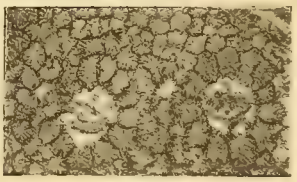
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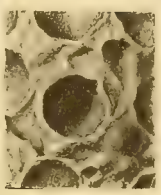
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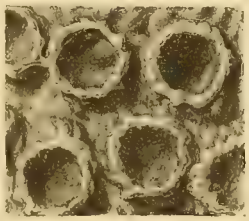
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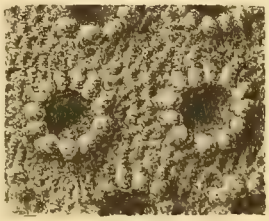
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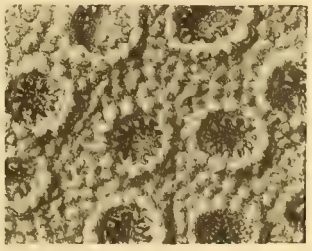
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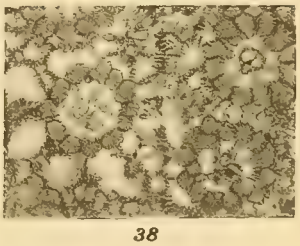
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Plate XI.

Diploëpora Grayi Edw. & H. p. 102.

Fig. 1. Longitudinal section of the bacular stratum, the vesicular stratum seen in the bottom. $^{10}/_{1}$.
» 2. Section of calicular tubes on the transition from vesicular coenenchyma to the bacular. $^{10}/_{1}$. In the lowest tube to the left as if columellas on the tabulæ.
» 3. Transverse section of the vesicular coenenchyma. $^{3}/_{1}$.
Fig. 4. Section of an entire branch of the coral from side to side showing the central vesicular coenenchyma surrounded by the bacular coenenchyma on both sides. Section placed in the direction of the growth. In the bacular coenenchyma at the right hand there is recurrence of the vesicular coenenchyma repeated four or five times. $^{3}/_{1}$.

Pycnolithus bifidus n. p. 105.

Fig. 5. Part of the surface magnified. $^{8}/_{1}$ Specimen probable from the stratum *a* near Wisby.
» 6. Transverse section a little below the surface. $^{8}/_{1}$.
» 7. Transverse section still deeper. $^{8}/_{1}$.
Fig. 8. Longitudinal section near the surface, showing grooves in the coenenchyma. $^{8}/_{1}$.
» 9. Longitudinal section. $^{8}/_{1}$. The tabulæ below the two upper ones have been made thicker through later accumulations. Longitudinal white lines thecæ of coenenchymal tubes.

Proheliolites dubius Fr. Schmidt p. 70.

Fig. 10. Surface in nat. size.
» 11. The same magnified. $^{8}/_{1}$.
» 12. The same magnified, favositoid and irregular. $^{8}/_{1}$.
» 13. Transverse section, lower down, $^{8}/_{1}$, septal spines incrassated through crystalline deposits. Specimen from Worms, Estland.
» 14. Longitudinal section showing parts of three calicles with septal spines directed downwards and covered with crystals of iron-oxidehydrate. Also from Worms. $^{20}/_{1}$.
Fig. 15. Transverse section of the same. $^{20}/_{1}$. Crystal accumulations also in the small incipient calicles.
» 16. Section of a specimen from a morainic deposit at Öjle myr, Gotland, collected by Dr C. Wiman. $^{8}/_{1}$. The calicular centre of several tubes is filled with a whitish siliceous mass and the septal spines are deformed, so as to look as if bifid.
» 17. Longitudinal section of the same, $^{8}/_{1}$, showing the downwards directed septal spines.

Heliolites hirsutus n. p. 64.

Fig. 18. Part of the surface, a little weathered. $^{6}/_{1}$. Specimen from Pattakumäggi, Estland, near Hapsal.
» 19. Transverse section a little below the surface, $^{6}/_{1}$, from the Alfvar near Hulterstad, Öland.
» 20. Part of a calicular tube, longitudinally sectioned, $^{12}/_{1}$, same locality.
Fig. 21. Side of a weathered polypary with three calicles visible. The septal spines deformed through weathering and posterior depositions, $^{12}/_{1}$; same locality.
» 22. Longitudinal section, same locality. $^{6}/_{1}$.

Acantholithus lateseptatus n. p. 113.

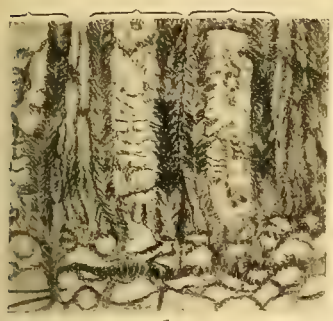
Fig. 23. A calicle magnified, $^{12}/_{1}$, with the surrounding coenenchyma. Specimen belonging to the Geological Survey of Sweden, found in a morainic mass near Kopparsvik, Wisby, Gotland.
» 24. Section of the same, a little below the surface. $^{12}/_{1}$.
» 25. Section lower down. $^{12}/_{1}$.
» 26. Surface in natural size.
» 27. Bottom stratum of the polypary just above the epithecal stratum. $^{12}/_{1}$. The black, branching figures probably caused by parasites.
Fig. 28. Microscopic structure of the epithecal stratum $^{12}/_{1}$.
» 29. Longitudinal section showing the scarce, concave tabulæ in the coenenchyma and in the calicle, and also the epithecal stratum in bottom, like a crusta. $^{12}/_{1}$.
» 30. Another longitudinal section with denser coenenchyma and the same epithecal stratum. Lacunæ through parasites or inorganic. $^{12}/_{1}$.

Acantholithus asteriscus p. p. Ferd. Roemer p. 113.

Fig. 31. Calicle and coenenchyma of a specimen from Wormsö, Estland. $^{12}/_{1}$.
» 32. A transverse, somewhat oblique section of the same. $^{12}/_{1}$. The left part deepest.
» 33. Longitudinal section of the same. $^{12}/_{1}$.
» 34. Magnified part of a surface, from Wormsö, Estland. $^{12}/_{1}$.
Fig. 35. Surface with two calicles, magnified. $^{12}/_{1}$. From the original specimen of Ferd. Roemer's Heliolites interstinctus in Silur. Diluv. Geschiebe von Sadewitz, Taf. IV, fig. 4, belonging to the Palæontological Museum at Breslau.

Plasmopora stella n. p. 83.

Fig. 36. Transverse section of a specimen from the stratum *a* near Wisby. To observe the most regular aureolas. $^{6}/_{1}$.
Fig. 37. Longitudinal section of the same. The larger aureolar space on both sides of the calicular tube clearly discernible from the other coenenchyma. $^{6}/_{1}$.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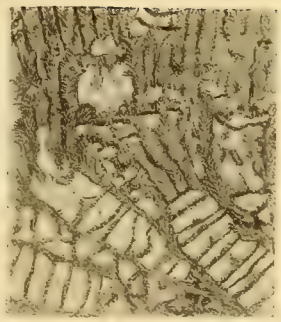
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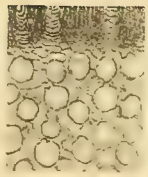
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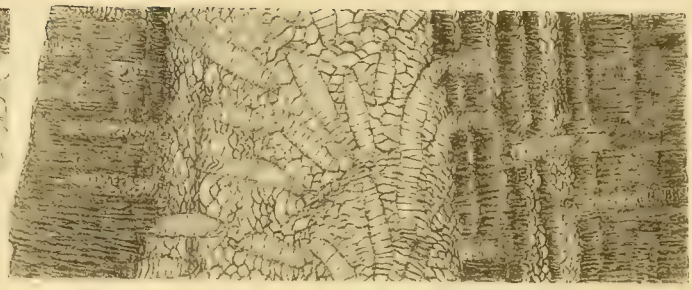
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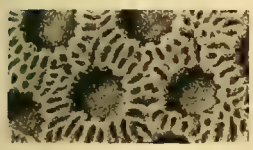
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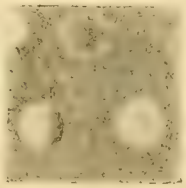
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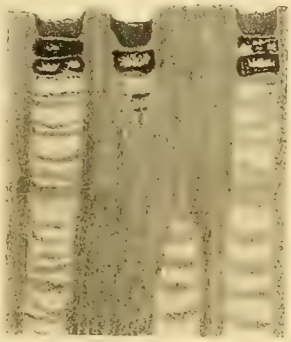
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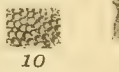
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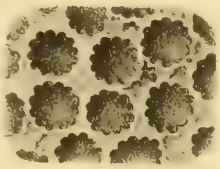
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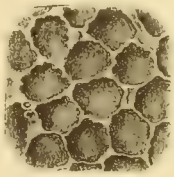
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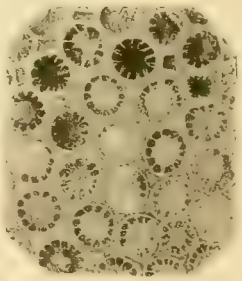
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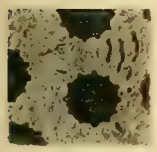
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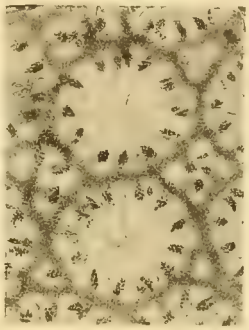
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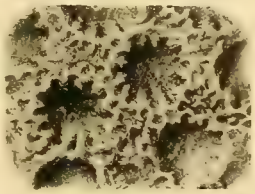
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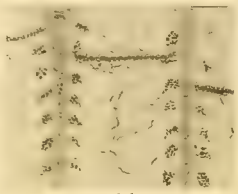
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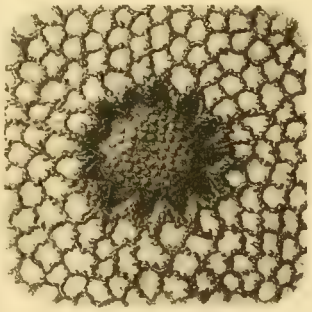
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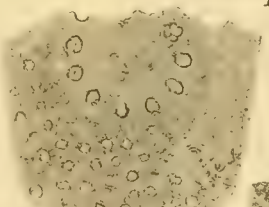
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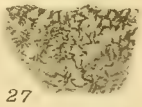
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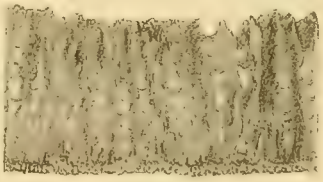
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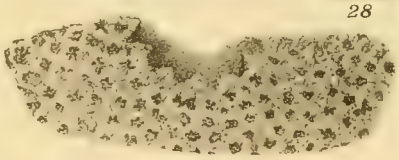
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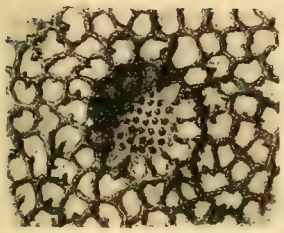
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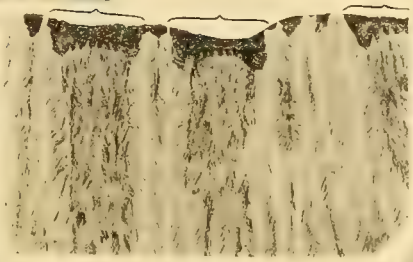
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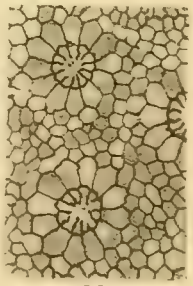
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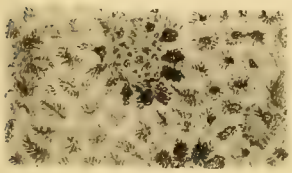
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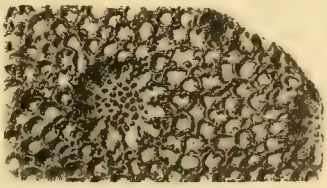
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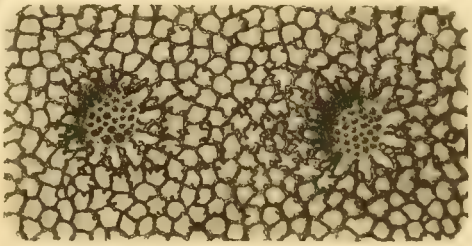
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Plate XII.

Acantholithus sp. *indet.* p. 114.

Fig. 1. Portion of the surface, from the stratum *a* of Wisby. $^{12}/_{1}$.

Fig. 2. Longitudinal section of the same. $^{12}/_{1}$.

Coccoseris Ungerni Eichwald p. 107.

Fig. 3. Portion of surface of specimen from Grossenhof, Estland. $^{12}/_{1}$.

» 4. The same natural size.

» 5. Surface, nat. size, probably a variety of the former, from Sutlep, Estland.

Fig. 6. Transverse section of this, across a calicle, with its central (columellar) and septal baculi. $^{20}/_{1}$.

» 7. Longitudinal section passing through two calicles. $^{20}/_{1}$. A narrow stripe of coenenchyma between them.

Coccoseris megastoma Mac Coy p. 108.

Fig. 8. Surface of specimen from Applethwaite, Westmoreland delineated from a positive cast in plaster taken on the negative original. $^{10}/_{1}$. Presented by Lector S. L. Törnquist.

» 9. Variety *minor* from Hulterstad, Öland. $^{12}/_{1}$.

Fig. 10. The same from the same locality, weathered specimen. $^{12}/_{1}$.

» 11. Surface in natural size of another specimen, same locality.

Coccoseris microporus Eichwald p. 107.

Fig. 12. Surface in nat. size, of a specimen from Borkholm, Estland.

» 13. Longitudinal section of the same. $^{20}/_{1}$.

» 14. Portion of the surface magnified. $^{12}/_{1}$.

Fig. 15. Portion of the original specimen of Eichwald's Heliolites microporus from Maals near Hapsal, now in the Museum of the University of St. Petersburg, kindly communicated by Professor Inostranzeff.

Coccoseris micraster n. p. 109.

Fig. 16. Surface in natural size, specimen from Östbjörka, Dalecarlia.

» 17. The same magnified. $^{10}/_{1}$.

Fig. 18. Longitudinal section showing two calicles and the bacular coenenchyma. $^{10}/_{1}$.

Protaræa vetusta J. Hall p. 111.

Fig. 19. A somewhat weathered specimen from Richmond, Indiana. $^{12}/_{1}$.

Fig. 20. Transverse section of specimen from same locality, $^{20}/_{1}$, four calicles sectioned. Observe the great similarity with fig. 6.

Fig. 21. An initial colony from Richmond, Indiana, grown on a brachiopodous shell. $^{12}/_{1}$.

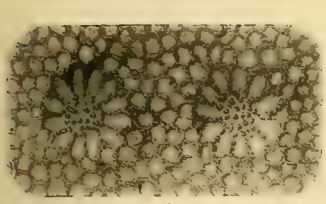
» 22. Longitudinal section of an older specimen, same locality. $^{20}/_{1}$.

» 23. Part of the surface of specimen from Wesenberg, Estland. $^{12}/_{1}$.

» 24. Portion of the surface of the original specimen of v. SEEBACH's Stylaræa Roemeri, kindly communicated by Prof. VON KOENEN. To be compared with fig. 19.

Fig. 25. Calicle of a recent *Thecopsammia*, magnified. This and the next figure are drawn by M. WESTERGREN, p. 14, 17.

» 26. Young colony of a *Turbinaria* grown on the surface of an older. Showing coenenchymal gemmation, p. 14.



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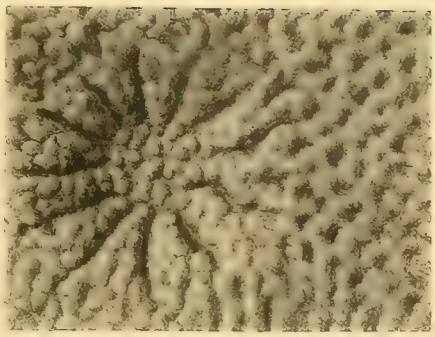

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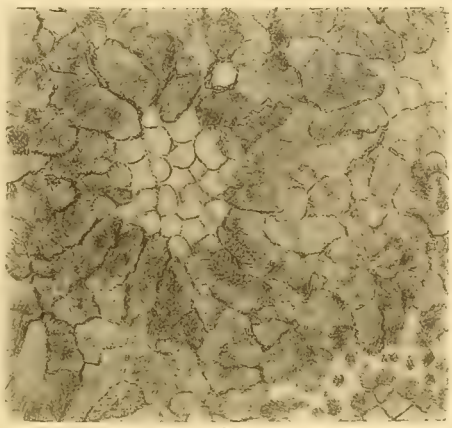

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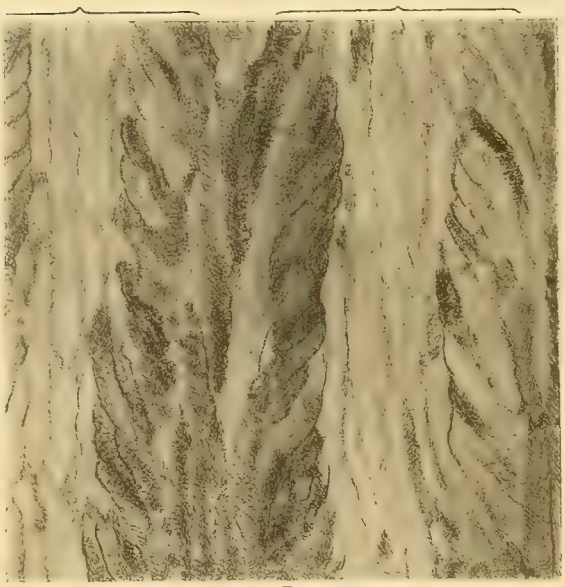

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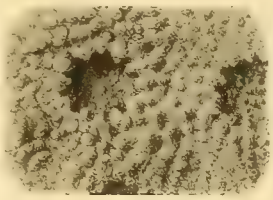

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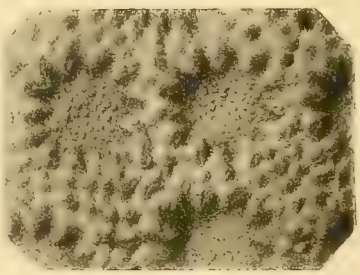

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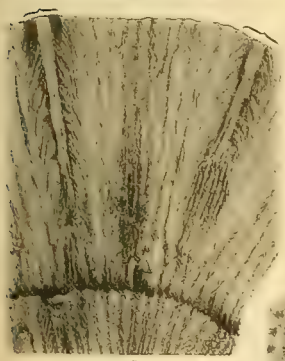

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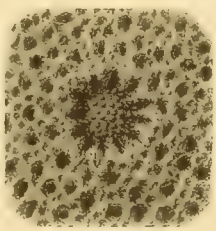

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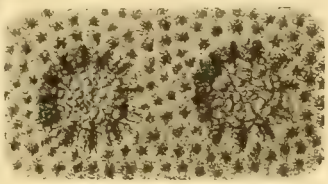

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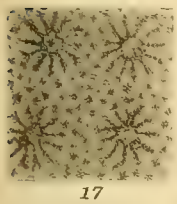

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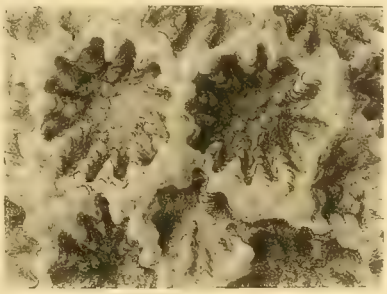

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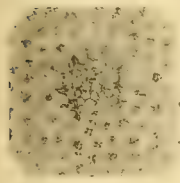

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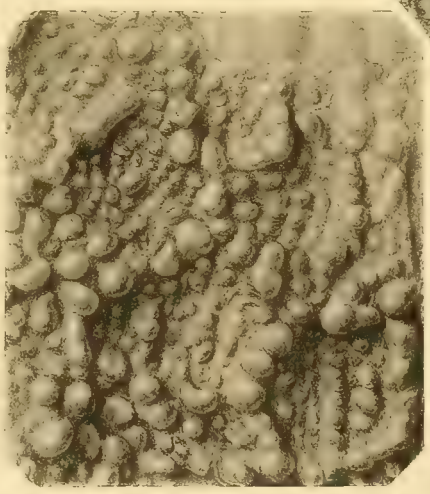

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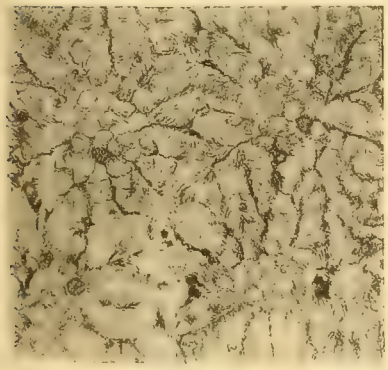

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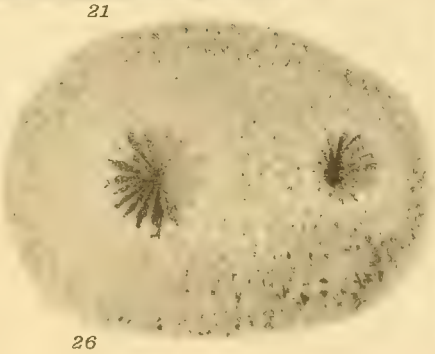

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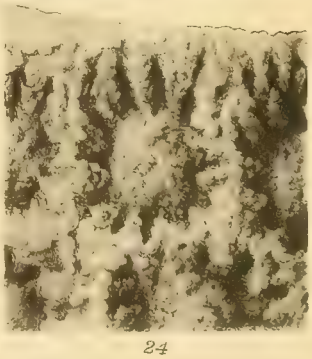

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KONGL. SVENSKA VETENSKAPS-AKADEMIENS HANDLINGAR. Bandet 32. N:o 2.

UNTERSUCHUNGEN

ÜBER

DIE SPECTRA DER METALLE

IM

ELECTRISCHEN FLAMMENBOGEN

V. SPECTRUM DES VANADS

VON

B. HASSELBERG

MIT DREI TAFELN

STOCKHOLM
KUNGL. BOKTRYCKERIET. P. A. NORSTEDT & SÖNER
1899

EINLEITUNG.

Durch die in meinen vorhergehenden Abhandlungen unter dem obigen Titel niedergelegten Untersuchungen habe ich die Spectroskopie der dem Eisen am nächsten stehenden Metalle zu einem vorläufigen Abschluss zu bringen gesucht. Ihre Verbindung mit den während desselben Zeitraumes theils von KAYSER und RUNGE theils von ROWLAND veröffentlichten Spectralarbeiten wird genügen um die am meisten dringenden Bedürfnisse auf diesem Gebiete der Spectroskopie zu befriedigen. Aber auch nicht mehr. Zu dem endlichen Ziel, der vollständigen Kenntniss der Spectra der Metalle, ist damit nur ein erster Schritt gethan, da aller Bemühungen ungeachtet sicherlich Niemand von uns sich der Hoffnung wird hingeben können mehr als die Hauptzüge dieser verwickelten Erscheinungen enträthzelt zu haben. Viele Einzelheiten von zweifelhafter Natur in den bisher vorliegenden Resultaten werden nämlich erst dann ihre richtige Deutung finden, wenn auch für die ganze Reihe der s. g. seltenen Metalle, die obwohl in spärlicher Qvantität häufig räumlich sehr verbreitet sind, ähnliche Untersuchungen durchgeführt seyn werden. In dem neulich erschienenen grossen Wellenlängencatalog des Sonnenspectrums von ROWLAND ist ein wichtiger Theil dieser Aufgabe allerdings erledigt; bei dem Umstande aber, dass im allgemeinen Sonnenspectrum mehrere dieser Metalle nur spärlich vertreten sind wird eine Wiederaufnahme und womöglich Weiterführung der Untersuchung nicht unmotivirt erscheinen.

Durch einen äusseren Umstand wurde ich dazu veranlasst unter diesen Metallen zunächst dem Vanad meine Aufmerksamkeit zuzuwenden. Vor ein Paar Jahre hatte nämlich Hr Baron NORDENSKIÖLD ein erhebliches Stück dieses Metalls von MOISSAN erhalten, welches Stück, vom Letzteren im electrischen Schmelzofen hergestellt, Baron NORDENSKIÖLD die Freundlichkeit hatte mir zur Verfügung zu stellen. Die Untersuchung des Bogenspectrums desselben war bereits so weit fortgeschritten, dass alle Messungen und Reductionen beinahe fertig vorlagen, als beim Vergleichen des Wellenlängencatalogs mit meinem vorher unter Anwendung eines norwegischen Rutils erhaltenen Titanspectrum im letzteren mehrere schwächere Linien angetroffen wurden, welche unzweifelhaft mit den stärksten Vanadlinien coincidirten und somit zu der unerwarteten Entdeckung eines Vanadgehalts dieses Minerals führten. Die hierdurch veranlasste Untersuchung einer ganzen Reihe

Rutilarten verschiedenen Ursprungs hat, wie anderweitig näher erörtert[1] das Vanad als einen fast allen Rutilarten gemeinsamen Bestandstheil festgestellt, zugleich aber den Abschluss der eigentlichen Untersuchung des Vanadspectrums verzögert. Inzwischen erschien im Aprilheft des Astrophysical Journals für 1898 eine Liste von Linien im Bogenspectrum dieses Metalls von ROWLAND und HARRISON. Von meiner anfangs gefassten Absicht unter solchen Umständen meine eigenen Untersuchungen als überflüssig ohne weiteres zu unterdrücken bin ich indessen später theils desshalb abgekommen, weil meine Messungen beim Erscheinen des Rowland'schen Catalogs bereits fast vollständig abgeschlossen waren, theils auch wegen des Umstandes dass meine Aufnahmen eine nicht unbedeutende Anzahl bei ROWLAND nicht vorkommender Linien enthalten, ohne dass ich vorläufig wenigstens genügende Veranlassung gehabt hätte dieselben als fremde Verunreinigungen aus meinem Verzeichniss auszuschliessen, während andererseits auch mehrere von ROWLAND's Linien bei mir vermisst werden. Von diesen letzteren Linien habe ich allerdings einige, wie weiter unten gezeigt werden soll, als leicht zu erkennende Verunreinigungen identificiren können, im Allgemeinen lässt sich jedoch, da ROWLAND nur die nackte Wellenlängenliste ohne jede Angabe über die Eliminirung fremder Linien giebt, ein näherer Einblick in diesen Verhältnissen nur schwer gewinnen. Schliesslich bietet wie mir scheint die Vergleichung der Ortsbestimmungen der uns gemeinsamen Linien, welche natürlich die überwiegende Mehrzahl bilden, ein nicht geringes Interesse. Bei dieser Vergleichung habe ich die Rowland'schen Wellenlängen, welche in drei Stellen der Ångström'schen Einheit ausgedrückt sind, auf zwei Stellen abgerundet, weil meine mit einem Plangitter erhaltenen Werthe keine grössere Genauigkeit als etwa zwei Einheiten dieser Stelle beanspruchen können. Unter der Voraussetzung, dass bei ROWLANDS Werthen die dritte Stelle reelle Bedeutung hat, was mir allerdings in Anbetracht der bei Metallinien häufig vorkommenden Verschwommenheit der Ränder und erheblichen Breite etwas fraglich erscheint, würde demnach der Haupttheil der zwischen uns auftretenden Differenzen meinen Messungen zur Last fallen. Wie man weiter unten aus den Wellenlängentafeln ersehen wird, ist indessen die Uebereinstimmung auch mit dieser Beschränkung fast durchweg eine sehr befriedigende.

[1] Vet.-Akad. Handlingar. Bihang. Bd 22. Afd. I. N:o 7. Bd 23. Afd. I. N:o 3. Astrophys. Journal. Vol. VI, 1897. — Einer Mittheilung in derselben Zeitschrift (Vol. VI, p. 157) zufolge soll ROWLAND schon früher das Vorkommen des Vanads in Rutil beobachtet haben. Es scheint indessen darüber nichts vor dem Erscheinen meiner Mittheilung veröffentlicht worden zu seyn. Uebrigens ist das Vorkommen des Vanads in einer Rutilart, wie ich neuerdings gefunden habe, schon lange vor uns auf rein chemischem Wege von SAINTE-CLAIRE DEVILLE entdeckt worden, nämlich im Rutil von Sainte Yrieix. Vergl. hierüber sowie über die weite Verbreitung des Metalls in verschiedenen Mineralien: Annales de Chimie et de Physique, III Série, T. LXI, p. 342, 1861 und W. F. HILLEBRAND in American Journal of Science Vol. VI, 1898, p. 209.

DER MESSAPPARAT.

Bei meinen bisherigen Untersuchungen der Metallspectra habe ich zur Ausmessung der photographischen Aufnahmen eine ältere Theilmaschine von PERRAUX benutzt. In Bezug auf die zu erzielende Genauigkeit ist gegen dieselbe allerdings nichts zu bemerken, wohl aber in Betreff der Bequemlichkeit beim Messen. Namentlich ist in dieser Hinsicht die vertikale Stellung des Mikroskops wegen schnell eintretender Ermüdung des Auges und die unnöthig grosse Länge der Schraube einer länger andauernden Benutzung derselben ausserordentlich hinderlich. Um diesen Uebelständen aus dem Wege zu gehen habe ich für die Ausmessung meiner Spectralaufnahmen einen besonderen sehr compendiösen Messapparat bauen lassen, dessen Einrichtung aus der Abbildung Taf. I leicht hervorgeht. Mit Hülfe von zwei messingenen Seitenstücken sind zwei Stahlschienen, von denen die eine oben eine Schneide bildet die andere eben ist, zu einem starken Rahmen verbunden, auf dem der Schlitten *S* mit dem darauf schräg befestigten Mikroskop durch die in den Seitenstücken gelagerte etwa 20 cm lange Schraube fortbewegt wird. Die Seitenstücke sind hinten verlängert und derartig zugeschnitten, dass auf denselben eine Messingplatte mit einem rectangulären Ausschnitt als Unterlage für die photographische Platte in solcher Lage befestigt werden kann, dass die Ebene der Letzteren sowohl der Schraube parallel als gegen die optische Achse des Mikroskops senkrecht zu stehen kommt. Um ferner die Längenrichtung des Spectralbildes der Schraube parallel zu stellen wird das Photogram zunächst auf einer starken planparallelen Glasscheibe befestigt, welche ihrerseits auf der erwähnten Messingplatte ruhend mittelst der beiden Schrauben *ss* und einer die Glasscheibe gegen dieselben drückenden Feder berichtigt werden kann. In dieser Weise lässt sich das Bild so justiren, dass beim Fortbewegen der Schraube das Fadenkreuz des Mikroskops dem Rande des Spectralbilds parallel läuft. Die Parallelstellung des einen Fadens des Mikroskops mit den Spectrallinien wird durch Drehung des Oculartheils und Festklemmen mit Hülfe der Schraube *u* bewirkt. Nachdem ferner das Ocular auf das Fadenkreuz scharf eingestellt worden ist erfolgt die schliessliche Scharfeinstellung der Spectrallinien durch Verschieben des ganzen Mikroskops mit Hülfe des Triebes *T*. Am Schlitten ist ein kleiner zur Beleuchtung der Platten dienender Spiegel nach allen Richtungen beweglich befestigt und schliesslich lässt sich mit Hülfe einer einfachen Auslösung *a* die Mutter von der Schraube trennen um eine rasche Bewegung des Schlittens zu ermöglichen.

Zur Ermittelung der periodischen und fortschreitenden Fehler der Schraube habe ich die Bessel'sche Methode benutzt. Das Mikroskop des Apparats wurde zu dem Zweck durch ein anderes, dem hiesigen Repsold'schen Längencomparator entnommenes, von erheblich stärkerer Vergrösserung ersetzt, worauf ein Fadenintervall im Ocularmikrometer des Letzteren von nahe 0.5 Umdrehungen der Schraube des Apparats in der Weise gemessen wurde, dass die beiden Fäden successive mit einem auf einer Glaslamelle gezogenen feinen Strich zur Deckung gebracht wurden. Die Messungen wurden von jedem Zehntel der Umdrehung

ausgehend jedesmal dreimal wiederholt und durch zehn successiven Windungen im mittleren Theil der Schraube fortgesetzt. In der Weise ergaben sich für das gemessene Intervall die folgenden Werthe:

Windung.	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
120—21	0.5138	0.5132	0.5098	0.5088	0.5067	0.5087	0.5083	0.5115	0.5128	0.5137
21—22	37	22	93	85	65	83	87	105	33	35
22—23	25	35	97	87	72	77	72	095	18	30
23—24	32	32	103	90	77	83	87	090	19	30
24—25	35	23	102	78	80	83	92	113	12	30
25—26	33	33	112	100	75	97	88	095	17	40
26—27	22	25	114	82	73	94	80	084	13	32
27—28	30	22	84	100	80	85	79	079	11	32
28—29	37	36	105	100	80	98	90	111	26	30
29—30	38	31	117	97	88	91	94	097	03	23
Mittel	0.51327	0.51291	0.51025	0.50907	0.50757	0.50878	0.50852	0.50984	0.51180	0.51319

und daraus weiter die Correctionsformel:

$$\Delta u = + 0.001365 \operatorname{Cos} u - 0.000248 \operatorname{Sin} u + 0.000466 \operatorname{Cos} 2u - 0{,}002927 \operatorname{Sin} 2u$$

welche auf den Anfang und das Ende jeder Messung angewandt zu den folgenden Werthen des Intervalls führt:

Anf.	0.0	$I = 0.5105$
»	0.1	5110
»	0.2	5106
»	0.3	5104
»	0.4	5101
»	0.5	5115
»	0.6	5104
»	0.7	5102
»	0.8	5105
»	0.9	5107
		0.51059.

Die Ausgleichung ist somit völlig genügend. Aus der mit Hülfe dieser Formel berechneten Correctionstafel ergiebt sich, dass die grösste Correction wegen periodischer Fehler, welcher ein mit diesem Theil der Schraube gemessenes Linienintervall unterliegt, numerisch 0.0065 nicht übersteigt, was im Spectrum III Ordnung meines Spectrographen, wo eine Umdrehung der Schraube etwa 1.3 Ångström'schen Einheiten entspricht, eine Correction der Wellenlängendifferenz von höchstens 0.008 Å. E. herbeiführt. Da ich nun beim Ausmessen meiner Aufnahmen die Genauigkeit nicht weiter als einem wahrscheinlichen Fehler von ± 0.02 Å. E. der abzuleitenden Wellenlängen entsprechend habe treiben können, so

wird für die vorliegenden Messungen die Berücksichtigung der periodischen Fehler der Schraube von keiner Bedeutung und dieselbe demnach als in dieser Hinsicht fehlerfrei zu betrachten seyn.

Um indessen die Zulässigkeit dieser Annahme etwas näher zu prüfen und zugleich auch über die Beschaffenheit der Schraube ein etwas zuverlässigeres Urtheil als es mit Hülfe der obigen, nur die mittleren Theile derselben betreffenden Untersuchungen möglich ist, zu gewinnen, habe ich ähnliche Messungen auch an zwei weiteren Stellen derselben in einem Abstand von je 40 Umdrehungen von der Mitte aus nach den Enden hin gerechnet ausgeführt. Diese Messungen des Intervalls wurden hier in jeder Gruppe nur durch fünf successiven Windungen wiederholt und führten zu den folgenden Werthen desselben:

		Rechts von der Mitte.	Links von der Mitte.
Anf.	0.0	$I = 0''.50736$	$I = 0''.51078$
	0.1	50236	51092
	0.2	50036	51082
	0.3	50184	51094
	0.4	50542	51174
	0.5	51246	51248
	0.6	51752	51220
	0.7	52032	51132
	0.8	51838	51074
	0.9	51390	51048
		0.50999	0.51124

Beim Vergleich dieser Zahlen mit den für die Mittelpartie erhaltenen ergiebt sich zunächst, dass die Fehler vom einen Ende der Schraube zum anderen abnehmen und für die nach rechts liegenden Windungen merklich grösser seyn müssen als für die übrigen Theile derselben. Die Mittelwerthe des gemessenen Intervalls

Rechts von der Mitte . . .	$I = 0''.50999$
Mitte	51052
Links von der Mitte	51124

zeigen ferner, dass die Windungen allmälich von rechts nach links an Höhe abnehmen. Was aber vom Gesichtspunkt der Beurtheilung der Schraube bedenklicher erscheint ist der Umstand, dass die Phase der Fehler vom einen Theil derselben zum andern sich ändert indem die Lage der Maxima und Minima des gemessenen Intervalls in den drei Messungsreihen nicht denselben Trommeltheilen entspricht. Es wird dadurch unmöglich die Gesammtheit der Messungen zu einem System zu vereinigen um daraus eine für die ganze Schraube gültige Fehlertafel abzuleiten, und man wäre streng genommen genöthigt entweder für die verschiedenen Theile verschiedene Fehlertafel zu entwerfen oder durch Wiederhohlen der Messungen von mehreren Ausgangspunkten der Trommel die periodischen Fehler zu eliminiren. Aus diesem Grund kann demnach die Schraube nicht als von erster Classe bezeichnet werden, da aber wie schon bemerkt die Fehler zu geringfügig sind um die

Genauigkeit der Messungen der Spectralaufnahmen merklich zu beeinträchtigen, so habe ich fürs erste von der Anschaffung einer neuen Schraube abgesehen. Was wiederum die Ursache dieses eigenthümlichen Verhaltens derselben betrifft, so lässt sich darüber augenblicklich kaum was bestimmtes aussagen, indessen dürfte die Vermuthung nicht ganz unwahrscheinlich seyn, dass hier eine Tordirung derselben, sey es während der Bearbeitung oder als elastische Nachwirkung nach der Härtung entstanden ist.

Um über die fortschreitenden Fehler eine Vorstellung zu gewinnen wurde ein Intervall der erwähnten Glaslamelle von 5 mm. oder nahe 10 Umdrehungen mit den 150 mittleren Gängen, welche bei den Spectralmessungen fast allein benutzt werden, gemessen. Diese Messungen ergaben:

Anf.	0	$l - 10$ = 0.0224	
	10	0235	
	20	0227	10.0226
	30	0229	
	40	0226	
	50	0247	
	60	0235	
	70	0242	10.0245
	80	0248	
	90	0254	
	100	0245	
	110	0261	
	120	0251	10.0258
	130	0263	
	140	0269	

aus denen die folgenden Correctionen hervorgehen:

f_0	= 0.0000	f_{80}	= + 0.0085
f_{10}	= + 0020	f_{90}	= + 0081
f_{20}	= + 0029	f_{100}	= + 0071
f_{30}	= + 0046	f_{110}	= + 0070
f_{40}	= + 0059	f_{120}	= + 0053
f_{50}	= + 0077	f_{130}	= + 0046
f_{60}	= + 0074	f_{140}	= + 0027
f_{70}	= + 0083	f_{150}	= + 0002

Man sieht, dass wie schon oben bemerkt die Höhe der Schraubengänge von rechts nach links allmälich ein wenig abnimmt zugleich aber, dass, da die auf den Photogrammen gemessenen Liniendistanzen gewöhnlich nur einige wenige Windungen betragen, die Correctionen dieser Intervalle wegen fortschreitender Fehler als völlig verschwindend vernachlässigt werden können. Aus diesem Grund habe ich es auch nicht nöthig erachtet durch Ausmessen mehrerer Intervalle auf der Glaslamelle einer schärferen Bestimmung der fortschreitenden Fehler nachzustreben.

ELIMINIRUNG FREMDER LINIEN.

Vanad und Eisen.

Bei dem ausserordentlichen Linienreichthum sowohl des Vanadspectrums als desjenigen des Eisens liess es sich schon im Voraus erwarten, dass die Zahl der wirklichen oder sehr angenäherten Coincidenzen eine beträchtliche sein würde. Obwohl schon bei der ersten Durchmusterung des Vanadspectrums durch gleichzeitige Vergleichung mit Aufnahmen des Eisens alle diejenigen Linien ausgeschieden wurden, von denen nach den Intensitätsverhältnissen zu urtheilen auf eine Zugehörigkeit zum letzteren Metall geschlossen werden konnte, ergab jedoch eine nachherige Vergleichung mit den Wellenlängentafeln von KAYSER und RUNGE eine unerwartet grosse Anzahl angenäherter Coincidenzen, bei denen die Linien um weniger als 0.1 Å. E. in der Wellenlänge von einander differirten. Um über diese Linienpaare sicher urtheilen zu können, habe ich wie gewöhnlich von den beiden Spectra Doppelaufnahmen auf derselben Platte hergestellt und die Lage der Componenten jedes Paares unter dem Mikroskop genau untersucht. Die Resultate dieser Beobachtungen zeigt die folgende Tafel, in welcher einerseits die Kayser-Runge'schen Wellenlängen durch Hinzufügung der Correction + 0.07 Å. E. auf das spätere Normalsystem von ROWLAND reducirt, und andererseits zum Zweck einer bequemeren Vergleichung ihre Intensitätsangaben nach Möglichkeit auf meine Skala übergeführt worden sind:

V		Fe		Bemerkungen.
λ	i	λ	i	
5761.70	1.2	5761.77	1	Fe fehlt.
27.90	2.3	27.93	1	
27.25	4	27.27	1	
07.26	3.4	07.22	1.2	Coinc? Fe-lin. schwach.
5627.86	3.4	27.79	1.2	Fe Spur, zweifelhaft.
24.80	2.3	24.77	4.5	Coinc.
05.20	2.3	05.19	1	Fe fehlt.
5592.67	3	92.71	1	
85.00	1.2	85.07	1.2	Getrennt. $\lambda_V < \lambda_{Fe}$.
5490.22	1.2	90.17	1	Fe fehlt.
88.18	2+	88.11	2	Getrennt. Fe-lin. v.v.
15.51	2.3	15.50	6	Wahrscheinlich getrennt.
5195.58	2—	95.66	2	Weit getrennt.
93.18	2	93.17	1	Fe fehlt.
92.22	1	92.17	1	
70.15	1+	70.15	1	
57.27	1—	57.75	1	

V		Fe		Bemerkungen.
λ	i	λ	i	
4871.46	2—	71.50	4.5	Coinc?
59.33	1.2	59.27	1	Fe fehlt.
27.62	3.4	27.64	1	Fe fehlt.
4757.68	2.3	57.77	2	Weit getrennt.
37.91	1 +	37.82	1	Fe fehlt.
31.74	1.2	31.67	1	
30.57	2	30.48	1	
14.28	2.3	14 38	1	
07.62	2	07.52	5	Weit getrennt.
05.26	2	05.17	2	Weit getrennt.
4630.23	1	30.29	3	Getrennt; $\lambda_V < \lambda_{Fe}$ $\Delta\lambda = 0\,07$.
26.67	2+	26.72	1	Fe fehlt Die Linie 26.72 gehört Mn.
18.96	1	18.95	2	Getrennt; $\lambda_V > \lambda_{Fe}$. Fe-lin. schwach.
06.33	2.3	06.41	1	Fe fehlt.
4594.27	4.5	94.32	1	
86.54	4.5	86.53	1	
83.96	2	84.00	2	Fe Spur. Wahrscheinlich $\lambda_{Fe} > \lambda_V$.
79.38	2.3	79.37	1	Fe fehlt.
37.88	2	37.81	1	Fe Spur. Coinc.?
29.80	2.3	29.82	3	Getrennt. $\lambda_V < \lambda_{Fe}$; Fe-lin. unbedeutend.
25.34	2 +	25.34	4	Coinc.? Vielleicht $\lambda_V < \lambda_{Fe}$.
20.33	2	20.42	1	Fe Spur. Getrennt.
14.36	2.3	14.36	2	Coinc.? Vielleicht $\lambda_V < \lambda_{Fe}$.
09.49	2	09.48	1	Fe fehlt.
4496.26	3	96.27	2	Coinc. Fe-lin. schwach.
91.66	1	91.60	1	Fe fehlt.
90.95	2.3	90.95	2	Coinc. Fe-lin. schwach.
74.84	3.4	74.94	1	Fe fehlt.
74.21	3	74.20	1	Fe fehlt.
60.47	4.5	60.55	1	Fe Spur. Getrennt.
59.93	4	59.95	1	Fe fehlt.
57.65	3.4	57.75	1	Getrennt.
52.19	4	52.29	1	Fe fehlt.
41.88	3.4	41.87	1	
38.02	3.4	37.95	1	
26.17	3	26.15	1	
25.86	2	25.86	1	
24.10	1.2	24.08	1	
23.41	2	23.36	1	Fe-lin. scheint in d. Mitte zu liegen.
23.32				
16.63	3	16.63	1	Fe fehlt.
12.30	2	12.22	2	Fe fehlt.
08.67	4.5	08.61	3.4	Getrennt. $\lambda_V > \lambda_{Fe}$.
07.85	4.5	07.87	3.4	Getrennt. $\lambda_V < \lambda_{Fe}$.
06.80	4.5	06.81	1	Fe fehlt.
00.74	4	00.79	1	Fe fehlt.

V		Fe		Bemerkungen.
λ	i	λ	i	
4395.40	4.5	95.46	1.2	Fe Spur.
91.84	1.2	91.75	1	Fe fehlt.
90.13	4.5	90.17	2	Fe fehlt.
84.87	4.5	84.89	2	Fe Spur.
84.37	1	84.45	1	Fe fehlt.
80.69	1.2	80.67	1	
79.38	4.5	79.43	2	
69.25	1+	69.25	1	
68.76	1.2	68.74	1	
4298.17	2.3	98.22	3	Getrennt. $\lambda_V < \lambda_{Fe}$.
96.28	2.3	96.20	1	Fe fehlt.
86.57	2	86.64	1	
84.19	3	84.26	1	
79.12	1.2	79.07	1	
69.92	2	69.95	1	Coinc.?
59.46	2	59.45	1	Fe fehlt.
40.53	2+	40.56	2	Getrennt. $\lambda_V < \lambda_{Fe}$.
39.12	1.2	39.07	5	Weit getrennt. Die Fe-linie ist zu intensiv notirt.
32.62	3	32.64	1	Fe fehlt.
29.87	2	29.93	1	
24.30	2	24.34	3.4	
10.55	1	10.55	5	Getrennt und $\lambda_V > \lambda_{Fe}$. Die Fe-lin. hat $\lambda = 10.49$.
4198.78	2—	98.82	2	Getrennt. $\lambda_V < \lambda_{Fe}$.
97.45	1	97.40	1	Coinc.? Fe äusserst schwach.
91.71	2.3	91.79	1	Fe fehlt.
79.57	2.3	79.53	1	
77.25	2—	77.23	1	
60.57	1+	60.66	1	
53.49	1.2	53.54	1	Fe Spur. Getrennt; $\lambda_V < \lambda_{Fe}$.
52.81	2	52.85	1	Fe fehlt.
42.75	1.2	42.81	2	Fe Spur. Coinc.?
41.96	1.2	42.01	2	Getrennt. $\lambda_V < \lambda_{Fe}$.
34.60	3.4	34.57	2	Ob getrennt? Fe schwach.
32.14	3.4	32.22	6	Getrennt. $\lambda_V < \lambda_{Fe}$.
29.00	2	28.98	1	Fe fehlt.
20.70	2	20.66	1	Getrennt. $\lambda_V > \lambda_{Fe}$.
19.58	2	19.52	2	Getrennt. $\lambda_V > \lambda_{Fe}$.
18.73	2	18.69	6	Getrennt. $\lambda_V > \lambda_{Fe}$.
16.85	1.2	16.93	1	Fe fehlt.
15.32	3.4	15.41	2	
13.66	2.3	13.59	1	
12.47	1.2	12.54	2	Wahrscheinlich getrennt. $\lambda_V < \lambda_{Fe}$.
11.93	4	11.92	2	Coinc. Fe nur Spur. Die Linie bei K.R gehört Ti.
09.94	3.4	09.95	5	Coinc. Gehört V | Fe.
08.36	2	08.30	1	Fe fehlt.
07.61	1.2	07.65	5	Vielleicht getrennt, $\lambda_V < \lambda_{Fe}$.

V		Fe		Bemärkungen.
λ	i	λ	i	
4105.32	3	05.35	2	Fe fehlt.
4099.93	3.4	99.94	2	
92.55	2	92.50	3	Getrennt. $\lambda_V > \lambda_{Fe}$.
92.09	1.2	92.18	1	Fe fehlt.
60.97	1+	60.95	1	Fe fehlt.
52.60	1	52.63	1	Wahrscheinlich getrennt. $\lambda_V < \lambda_{Fe}$.
51.48	2.3	51.47	1	Fe fehlt.
35.77	2	35.83	2	Weit getrennt.
32.62	1.2	32.61	1	Fe Spur.
31.37	1 2	31.40	1	Fe Spur.
23.50	2	23.58	1	Fe fehlt.
20.69	1	20.61	1	
15.50	1	15.47	1	
11.45	1+	11.56	1	Getrennt.
09.94	1	09.87	3.4	Weit getrennt.
3998.87	3	98.83	1	Fe fehlt.
97.30	1.2	97.32	1	
73.79	2	73.82	3	Getrennt. $\lambda_V < \lambda_{Fe}$.
41.40	1.2	41.47	2	Weit getrennt.
25.36	2+	25.38	1	Fe fehlt.
14.45	2	14.42	1	Getrennt. $\lambda_V > \lambda_{Fe}$.
10.95	2	11.02	2	Getrennt. $\lambda_V < \lambda_{Fe}$.
10·01	3	10.02	3	Getrennt. $\lambda_V > \lambda_{Fe}$.
06.89	2	06.91	2	Coinc.
3898.16	3	98.12	3.4	Coinc? V-lin v. Ob V?
94.19	2	94.16	2	Getrennt. $\lambda_V > \lambda_{Fe}$.
93.03	3	93.07	1	Getrennt. $\lambda_V < \lambda_{Fe}$.
86.36	1	86.45	3.4	Getrennt. Ob V?
76.21	2.3	76 21	3	Getrennt. $\lambda_V > \lambda_{Fe}$. $\Delta\lambda = 0.05$.
56.00	4	56.07	1	Getrennt. $\lambda_V < \lambda_{Fe}$.
55.50	3	55.52	1	Vielleicht getrennt.
40.56	2.3	40.65	5	Schwer zu trennen. $\lambda_V < \lambda_{Fe}$. λ_{Fe} zu gross; soll sein 40.59.
39.53	2	39.45	4	Weit getrennt.
28.66	3.4	28.72	1	Fe fehlt.
17.98	1.2	17.91	1	
06.93	2	06.91	3 4	Getrennt. $\lambda_V < \lambda_{Fe}$.
3795.12	3.4	95.20	5	Getrennt. $\lambda_V < \lambda_{Fe}$.
93.76	2	93.67	1	Getrennt.
78.83	2.3	78.89	1	Wahrscheinlich $\lambda_V < \lambda_{Fe}$.
77.63	1	77.63	2	Getrennt. $\lambda_V > \lambda_{Fe}$.
61.61	1+	61.59	1	Getrennt. $\lambda_V > \lambda_{Fe}$.
56.18	1	56.24	1	Getrennt. $\lambda_V < \lambda_{Fe}$.
46.02	2	46.02	4	Getrennt. $\lambda_V < \lambda_{Fe}$.
40.38	1.2	40.29	1	Fe fehlt.
22.76	2	22.76	4	Getrennt. $\lambda_V > \lambda_{Fe}$.
08.88	1.2	08.79	1	Getrennt.

V		Fe		Bemerkungen.
λ	i	λ	i	
3703.71	3.4	03.75	3	Nicht zu trennen. V-lin. umgekehrt.
3687.61	2.3	87.65	4	Wahrscheinlich getrennt.
86.40	2	86.47	1	Eine kräftige Fe-lin. coinc. m. V.
83.27	3	83.25	1	Fe fehlt.
65.88	1	65.97	1	Getrennt. $\lambda_V < \lambda_{Fe}$.
65.30	2	65.40	1	Fe fehlt.
63.73	2.3	63.67	1	
45.77	1.2	45.70	1	Getrennt.
38.57	1	38.51	3	Getrennt. $\lambda_V > \lambda_{Fe}$.
21.37	2.3	21.31	1	Fe fehlt.
20.53	1.2	20.44	1	
16.91	1+	16.83	1	Getrennt. Fe spur.
14.39	1.2	14.33	1	Fe fehlt.
11.00	1.2	10.93	1	Getrennt.
05.75	1.2	05.69	3	Getrennt. $\lambda_V > \lambda_{Fe}$.
3593.48	2	93.53	1	Coinc.
92.71	1+	92.68	1	Getrennt. $\lambda_V > \lambda_{Fe}$.
83.84	1+	83.81	1	Fe-lin. zweifelhaft.
78.01	1+	78.10	2	Coinc. λ_{Fe} correct? Gemeinschaftliche Verunreinigung?
75.26	1	75.29	1	Kaum zu trennen.
69.11	1.2	69.16	2	Getrennt. $\lambda_V < \lambda_{Fe}$.
53.43	3	53.36	1	Fe fehlt.
43.68	1.2	43.60	1	
29.90	2—	29.97	3	Weit getrennt.
24.38	2+	24.41	2	Wahrscheinlich getrennt, $\lambda_V < \lambda_{Fe}$.
20.18	2	20.21	1	Fe Spur. Coinc?
04.57	1.2	04.59	1	Fe fehlt.
3493.34	1	93.44	1	Getrennt. Fe Spur.
89.63	1	89.56	1	Getrennt. Fe Spur.
83.91	2.3	83.98	1	Fe fehlt.
76.15	2	76.24	1	

Ähnlich wie in früheren Fällen habe ich auch hier eine bedeutende Anzahl der schwächsten bei Kayser und Runge vorkommenden Eisenlinien auf meinen Platten nicht wiederfinden können. Fügt man zu denselben noch die Paaren, welche auf den Doppelaufnahmen mit grösserer oder geringerer Sicherheit haben getrennt werden können, so bleibt im obigen Verzeichniss nur eine ziemlich unbedeutende Anzahl Paare übrig, in Bezug auf welche noch Unsicherheit besteht. Von diesen mögen die folgenden Coincidenzen hier besonders aufgeführt werden, welche nach den Kayser-Runge'schen Intensitätsangaben zu urtheilen als beiden Metallen gehörend angesehen werden müssten:

V		Fe	
λ	i	λ	i
5624.80	2.3	5624.77	4.5
4525.34	2+	25.34	4
14.36	2.3	14.36	2
4496.26	3	96.27	2
90.95	2.3	90.95	2
4111.93	4	11.92	2
09.94	3.4	09.95	5
3906.89	2	06.91	2
3898.16	3	98.12	3.4
3703.71	3.4	03.75	3
3593.48	2	93.53	1
78.01	1.2	78.10	2

Es muss indessen bemerkt werden, dass bei einigen dieser Eisenlinien die Intensität auf meinen Platten viel geringer als hier angegeben erscheint, so dass es wohl wahrscheinlich sein dürfte, dass dieselben Verunreinigungen des Kayser-Runge'schen Eisenspectrums sind. Eine solche Linie ist 4111.92 welche auch bei Titan mit erheblicher Intensität vorkommt und daher bei KAYSER und RUNGE ohne Zweifel einer Verunreinigung durch dies Metall zuzuschreiben ist. Bei dem letzten Paare, welches auf dem Doppelbild nicht getrennt werden konnte, liegt vermuthlich ein Fehler von 0.1 Å E. vor.

Vanad und Titan.

Die Vergleichung der Wellenlängencataloge dieser beiden Metalle, sowie die nähere Untersuchung der Doppelaufnahmen haben zu den in der beistehenden Tafel gegebenen Resultaten geführt.

V		Ti		Bemerkungen.
λ	i	λ	i	
4819.22	1.2	19.20	1.2	Vielleicht getrennt.
4799.94	2+	99.95	2.3	Coinc.
98.12	1.2	98.13	2	Coinc.
31.42	1.2	31.33	2.3	Weit getrennt.
4684.64	2	84.68	1.2	Getrennt. $\lambda_V < \lambda_{Ti}$.
4591.27	4.5	94.28	1	Coinc. Gehört V.
49.82	3	49.79	3	Getrennt. $\lambda_V > \lambda_{Ti}$.
15.75	1.2	15.76	1.2	Vielleicht getrennt.
4496.26	3	96.33	3	Weit getrennt.
95.16	1.2	95.19	3	Getrennt. $\lambda_V < \lambda_{Ti}$.
57.65	3.4	57.59	3.4	Getrennt.
44.40	3.4	44.41	1.2	Coinc. Gehört V.
41.88	3.4	41.86	1.2	Coinc. Gehört V.

V		Ti		Bemerkungen.
λ	i	λ	i	
4426.17	3	26.24	2.3	Getrennt. $\lambda_V < \lambda_{Ti}$.
16.63	3	16.70	2	Getrennt. $\lambda_V < \lambda_{Ti}$.
08.67	4.5	08.70	1.2	Coinc. Gehören V.
08.35	4	08.39	1.2	
07.85	4.5	07.85	1.2	
00.74	4	00.74	1.2	
4394.01	1.2	94.04	3	Getrennt. $\lambda_V < \lambda_{Ti}$.
90.13	4.5	90.11	2	Coinc. Gehören V.
84.87	4.5	84.85	2	
79.38	4.5	79.40	2	
53.02	3.4	53.01	1	
15.00	1.2	14.95	3.4	Getrennt. $\lambda_V > \lambda_{Ti}$.
4227.90	2	27.80	2	Getrennt.
4183.46	1+	83.45	1.2	Getrennt. $\lambda_V < \lambda_{Ti}$.
69.42	1.2	69.46	2	Getrennt. $\lambda_V < \lambda_{Ti}$.
59.85	2.3	59.79	2.3	Getrennt. $\lambda_V > \lambda_{Ti}$.
34.60	3.4	34.60	1.2	Coinc. Gehört V.
31.32	1	31.38	1.2	Getrennt. $\lambda_V < \lambda_{Ti}$.
28.25	3.4	28.20	2	Coinc. Gehört V.
23.65	3	23.68	2.3	Scheinen getrennt, $\lambda_V < \lambda_{Ti}$.
23.35	2	23.42	2	Getrennt.
16.65	3	16.64	1.2	Coinc. Gehört V.
15.32	3.4	15.32	2	Coinc. Gehören V. 11.91 auch Ti.
11.93	4	11.91	2.3	
09.94	3.4	09.92	1.2	
05.32	3	05.31	1.2	
4099.93	3.4	99.94	1.2	
95.64	3	95.65	1	
92.83	3	92.83	1.2	
90.70	3	90.73	1	
15.50	1	15.56	2	Getrennt. $\lambda_V < \lambda_{Ti}$.
13.67	1	13.72	2.3	Getrennt. $\lambda_V < \lambda_{Ti}$.
3998.87	3	98.77	4	Weit getrennt.
3888.23	1+	88.20	2	Getrennt. $\lambda_V > \lambda_{Ti}$.
56.00	4	55.99	1.2	Coinc. Gehört V.
40.88	3	40.90	2	Coinc. Gehört V.
40.56	2.3	40.48	1	Getrennt?
36.20	2—	36.22	1.2	Vielleicht getrennt.
33.36	1+	33.33	2	Getrennt. $\lambda_V > \lambda_{Ti}$.
23.00	2+	23.03	1	Coinc. Gehört V.
22.14	2.3	22.16	2.3	Getrennt. $\lambda_V < \lambda_{Ti}$.
18.37	3	18.38	2	Coinc. Gehört V.
3798.40	1.2	98.47	1.2	Weit getrennt.
82.29	1	82.26	1.2	Getrennt. $\lambda_V > \lambda_{Ti}$.
66.58	1.2	66.60	1	Getrennt. $\lambda_V < \lambda_{Ti}$.
22.76	2	22.70	2.3	Wahrscheinlich getrennt, $\lambda_V > \lambda_{Ti}$.

V		Ti		Bemerkungen.
λ	i	λ	i	
3708.88	1.2	08.83	1.2	Getrennt. $\lambda_V > \lambda_{Ti}$.
04.85	3	04.84	1	}
3692.37	3	92.35	2	} Coinc. Gehören V.
88.22	2.3	88.19	1	}
63.73	2.3	63.82	1	Getrennt.
44.88	1.2	44.87	2	Coinc.
36.09	2	36.05	1	Wahrscheinl. Coinc. Gehört V.
14.39	1.2	14.35	2	Coinc. Gehört Ti.
3493.34	1	93.44	1	Weit getrennt.

Man findet zunächst, dass hier mehrere genaue Coincidenzen vorliegen, bei denen die Linien im Spectrum des Vanads sehr intensiv, in demjenigen des Titans dagegen schwach sind, und folglich dem ersteren Metall ganz unzweifelhaft zugeschrieben werden müssen. Da zur Zeit meiner Untersuchung des Titans das Vanadspectrum mir noch unbekannt war, und ausserdem über die vor bald 40 Jahren von Sainte-Claire Deville gemachte Entdeckung des Metalls in einer französischen Rutilart in einem so umfassenden Werk wie Dana's System of Mineralogy keine Mittheilung sich findet, so hatte ich, wie man zugeben dürfte, keine Veranlassung in dem von mir zur Darstellung des Titanspectrums benutzten norwegischen Rutil die Gegenwart dieser Verunreinigung zu vermuthen. Die jetzt gewonnene Erfahrung zeigt nun, dass auch diese Rutilart Vanadhaltig ist, und dass demzufolge die folgenden Linien als dem Vanad gehörend aus meinem Catalog der Titanlinien ausgeschieden werden müssen:

$\lambda = 4594.28$	$i = 1$	$\lambda = 4109.92$	$i = 1.2$
4444.41	1.2	05.31	1.2
41.86	1.2	4099.94	1.2
08.70	1.2	95.65	1
08.39	1.2	92.83	1.2
07.85	1.2	90.73	1
00.74	1.2	3855.99	1.2
4390.11	2	40.90	2
84.85	2	23.03	1
79.40	2	18.37	2
53.01	1	3704.84	1
4134.60	1.2	3692.35	2
28.20	2	88.19	1
16.64	1.2	36.05	1
15.32	2		

Lässt man ferner im obigen Verzeichniss diejenigen Linienpaare, deren Glieder getrennt, und demnach von einander unabhängig sind bei Seite, so bleiben für Vanad und Titan gemeinsam die Linien,

V		Ti	
λ	i	λ	i
4799.94	2+	99.95	2.3
4111.93	4	11.91	2.3

während als noch nicht sicher getrennt oder möglicherweise von einem dritten Metall herrührend zu verzeichnen sind:

V		Ti	
λ	i	λ	i
4819.22	1.2	19.20	1.2
4798.12	1.2	98.13	2
4515.75	1.2	15.76	1.2
3836.20	2—	36.22	1.2
3844.88	1.2	44.87	2

Unter diesen Linien scheint nur beim zweiten und letzten Paare die Coincidenz genau zu sein. Von den übrigen kommt die Linie 3836.22 auch als schwächere Linie bei Chrom vor und ist bei der Untersuchung des Titans als eine mögliche Verunreinigung dieser beiden Metalle verzeichnet worden.[1] Da nun wie gleich weiter unten sich zeigen wird die Vanadlinie 3836.20 von der Chromlinie getrennt erscheint, so ist es wahrscheinlich, dass dieselbe auch von der Titanlinie unabhängig ist.

Vanad und Chrom.

Von den angenäherten Coincidenzen in den Spectra des Vanads und des Chroms ist wie die folgende Tabelle zeigt die Mehrzahl aus von einander unabhängigen Linien gebildet:

V		Cr		Bemerkungen.
λ	i	λ	i	
5225.97	1.2	25.98	1.2	
5192.22	1	92 17	2.3	
39.74	2—	39.82	2.3	
4851.65	4	51.65	1.2	Cr-lin. äusserst schwach. Coinc?
31.80	3.4	31.79	1.2	Coinc. Gehört V.
4766.80	2.3	66.77	2	Coinc.
57.49	1.2	57.55	2	Getrennt.
54.13	2.3	54.10	1	Getrennt. $\lambda_V > \lambda_{Cr}$.
17.85	2.3	17.87	1.2	Getrennt. $\lambda_V < \lambda_{Cr}$.
06.34	2.3	06.25	1.2	Weit getrennt.

[1] Vetenskaps-Akad. Handl. Bd 28. N:o 1, p. 16.

V		Cr		Bemerkungen.
λ	i	λ	i	
4681.07	1.2	81.01	2	Getrennt. $\lambda_V > \lambda_{Cr}$. $\Delta\lambda < 0.06$.
69.50	1+	69.50	2.3	Wahrscheinlich getrennt, $\lambda_V < \lambda_{Cr}$.
66.33	2+	66.35	2.3	Getrennt. $\lambda_V < \lambda_{Cr}$. $\Delta\lambda > 0.02$.
54.84	1.2	54.90	2.3	Weit getrennt.
49.08	1.2	49.04	2.3	Wahrscheinlich getrennt, $\lambda_V > \lambda_{Cr}$.
48.08	1	48.00	1.2	V-lin. fehlt.
00.34	1.2	00.25	2.3	Getrennt. $\lambda_V > \lambda_{Cr}$.
4583.96	2	84.02	1.2	Cr-lin. fehlt.
45.60	3.4	45.51	2.3	Weit getrennt.
31.01	2+	30.92	4	Weit getrennt.
4497.03	2+	97.02	3.4	Coinc. Gehört V | Cr.
59.93	4	59.95	2+	Coinc. Gehört V | Cr.
28.67	3	28.71	2	Coinc. Gehört V | Cr.
23.41	2	23.46	1.2	Getrennt. $\lambda_V < \lambda_{Cr}$.
4391.84	1.2	91.90	2.3	Weit getrennt.
80.69	2	80.73	1	Cr-lin. kaum sichtbar.
75 47	2	75.52	2.3	Vielleicht $\lambda_V < \lambda_{Cr}$. $\Delta\lambda < 0.05$.
73.40	2	73.41	3	Getrennt. $\lambda_V < \lambda_{Cr}$. $\Delta\lambda > 0.01$.
12.56	1+	12.65	1.2	Weit getrennt.
4297.86	2.3	97.91	2.3	Getrennt. $\lambda_V < \lambda_{Cr}$.
62.32	2	62.27	1.2	Getrennt. $\lambda_V > \lambda_{Cr}$.
55.60	1.2	55.65	2	Getrennt. $\lambda_V < \lambda_{Cr}$.
39.12	1.2	39.08	2.3	Coinc.
34.70	2.3	34.64	1.2	Wahrscheinlich $\lambda_V > \lambda_{Cr}$. $\Delta\lambda < 0.06$.
16.52	1	16.50	2	Vielleicht $\lambda_V < \lambda_{Cr}$.
04.67	1	04.61	2	Getrennt. $\lambda_V > \lambda_{Cr}$.
00.35	2	00.27	2	Weit getrennt.
4197.45	1	97.38	2	Getrennt. $\lambda_V > \lambda_{Cr}$.
52.81	1.2	52.89	1.2	Weit getrennt.
20.70	2	20.78	2	Weit getrennt.
4067.90	1.2	67.94	1	Cr-lin. fehlt.
51.48	2.3	51.47	1.2	Coinc. Gehört V | Cr.
3992.95	3	92.95	2.3	Ein wenig getrennt. $\lambda_V < \lambda_{Cr}$.
63.77	2	63.82	3.4	Getrennt. $\lambda_V < \lambda_{Cr}$.
3894.19	2	94.20	3	Coinc. Gehört V | Cr.
52.27	1	52.33	2	Getrennt.
49.48	2	49.48	2.3	Vielleicht $\lambda_V < \lambda_{Cr}$.
36.20	2	36.22	2	Getrennt. $\lambda_V < \lambda_{Cr}$.
22.14	2.3	22.22	1	Getrennt.
21.63	2	21.71	1.2	Weit getrennt.
20.10	2+	20.11	1	Coinc.
17.98	1.2	17.97	1.2	Coinc.
06.93	2	06.97	2	Getrennt. $\lambda_V < \lambda_{Cr}$.
3790.62	2	90.61	2	Coinc.
3696.00	3	96.02	1	Coinc.
88.22	2.3	88.24	1	Coinc.

V		Cr		Bemerkungen.
λ	i	λ	i	
3687.61	2.3	87.65	2.3	Wahrscheinlich getrennt. $\lambda_V < \lambda_{Cr}$.
80.26	3	80.34	1	Weit getrennt.
49.14	2	49.12	3	Coinc. Gehört V | Cr.
3574.92	1	74.93	2.3	Wahrscheinlich getrennt. $\lambda_V < \lambda_{Cr}$.

Genaue Coincidenz mit erheblicher Intensität der Linien in beiden Spectra zeigen die folgenden Paare:

V		Cr	
λ	i	λ	i
4766.80	2.3	66.77	2
4497.03	2+	97.02	3.4
59.93	4	59.95	2+
28.67	3	28.71	2
4051.48	2.3	51.47	1.2
3894.19	2	91.20	3
3790.62	2	90.61	2
3649.14	2	49.12	3

welche demnach vorläufig beiden Metallen zuzuchreiben sein dürften. Ausser diesen Coincidenzen kommen einige wenige vor, bei denen wegen der sehr geringen Intensität der dem Chrom zugeschriebenen Componenten auf eine Verunreinigung des Chroms durch Vanad geschlossen werden konnte, allein da von den für Vanad am meisten characteristischen Gruppen bei Chrom nichts gefunden worden ist, scheint mir dies wenig wahrscheinlich. Solche Linien sind:

V		Cr	
λ	i	λ	i
4831.80	3.4	31.79	1.2
4380.69	2	80.73	1
3820.10	2.3	20.11	1
3696.00	3	96.02	1
88.22	2.3	88.24	1

Vanad und Mangan.

Beim Vergleich des Vanadspectrums mit demjenigen des Mangans habe ich nur eine geringe Anzahl Linien mit nahezu identischen Wellenlängen angetroffen. Auf den Doppelaufnahmen zeigen sie sich fast durchweg von einander getrennt.

V		Mn		Bemerkungen.
λ	i	λ	i	
4626.67	2+	26.74	2	Getrennt.
4460.47	4.5	60.55	2.3	Weit getrennt.
57.65	3.4	57.71	3	Weit getrennt.
08.35	4	08.28	1.2	Weit getrennt.
4284.19	3	84.22	2.3	Scheinen getrennt. $\lambda_V < \lambda_{Mn}$.
61.37	2—	61.45	1.2	Weit getrennt.
4149.02	1.2	48.94	2.3	Weit getrennt.
31.32	1	31.26	2.3	Getrennt. $\lambda_V > \lambda_{Mn}$.
23.65	3	23.68	1.2	Getrennt. $\lambda_V < \lambda_{Mn}$.
23.35	2—	21.41	1.2	Getrennt. $\lambda_V < \lambda_{Mn}$.
4090.70	3	90.73	1+	Wahrscheinlich getrennt. $\lambda_V < \lambda_{Mn}$.
52.60	1	52.62	2	Coinc. Gemeinschaftliche Verunreinigung?
3997.30	1.2	97.34	1	Getrennt. $\lambda_V < \lambda_{Mn}$.
3886.36	1	86.42	2.3	Getrennt.
06.93	2	06.84	4.5	Weit getrennt.
3719.06	1+	19.04	2.3	Coinc? Gehört Mn.
3680.26	3	80.32	1	Getrennt. $\lambda_V < \lambda_{Mn}$.
3578.01	1+	77.99	3.4	Coinc. Gehört V | Mn. Andere intensive Mn-linien fehlen völlig im V-spectrum.

Vanad und Cobalt.

Auch hier sind, wie aus der folgenden Tafel hervorgeht, die gefundenen angenähert coincidirenden Linienpaare aus von einander unabhängigen Gliedern gebildet:

V		Co		Bemerkungen.
λ	i	λ	i	
4793.10	2	93.03	4	Getrennt. $\lambda_V > \lambda_{Co}$.
42.79	2	42.76	1	Fehlt bei Co auf der Vergleichsplatte.
37.91	1+	37.95	2.3	Getrennt. V-lin schwach $\lambda_V < \lambda_{Co}$.
21.70	2.3	21.61	1.2	Getrennt.
4640.92	2	40.99	1.2	Getrennt. $\lambda_V < \lambda_{Co}$.
24.62	2+	24.70	1.2	Getrennt.
14.08	1	14.18	2	V-lin. fehlt.
07.40	1.2	07.46	2	Co-lin. kaum sichtbar.
4588.94	1+	88.85	2	Getrennt. $\lambda_V > \lambda_{Co}$.
49.82	3	49.80	4	Ein wenig getrennt, aber $\lambda_V < \lambda_{Co}$.
28.20	2.3	28.12	2.3	Getrennt.
14.36	2.3	14.33	2.3	Getrennt. $\lambda_V > \lambda_{Co}$.
4467.04	2	67.04	3.4	Ein wenig getrennt, $\lambda_V < \lambda_{Co}$.
38.02	3.4	38.05	1	Von Co nur Spur.
36.31	3.4	36.37	1.2	Getrennt. $\lambda_V < \lambda_{Co}$.
16.63	3	16.63	1.2	Unmöglich zu trennen. Vielleicht $\lambda_V < \lambda_{Co}$.
4379.38	4,5	79.37	1.2	Wahrscheinlich getrennt und $\lambda_V < \lambda_{Co}$.

V λ	V i	Co λ	Co i	Bemerkungen.
4320.46	1+	20.53	1.2	Getrennt.
4298.17	2.3	98.14	1.2	Getrennt. $\lambda_V > \lambda_{Co}$.
70.49	2	70.58	1.2	Weit getrennt.
4104.92	2	04.89	2	Getrennt. $\lambda_V > \lambda_{Co}$.
04.55	2	04.57	2	Getrennt. $\lambda_V < \lambda_{Co}$.
4092.55	2	92.55	4	Vielleicht getrennt, und $\lambda_V > \lambda_{Co}$.
35.77	2	35.73	3.4	Getrennt.
23.50	2	23.54	1.2	Coinc. Fremde Linie?
3979.59	2—	79.65	3	Weit getrennt.
75.51	1	75.48	1.2	Getrennt. $\lambda_V > \lambda_{Co}$.
25.36	2+	25.32	1.2	Getrennt. $\lambda_V > \lambda_{Co}$.
10.01	3	10.08	3.4	Weit getrennt.
3894.19	2	94.21	5	Getrennt. $\lambda_V < \lambda_{Co}$.
70.72	1+	70.65	2	Getrennt. $\lambda_V > \lambda_{Co}$.
32.97	1+	33.02	1.2	Getrennt. $\lambda_V < \lambda_{Co}$.
20.10	2+	20.02	2	Weit getrennt.
3777.63	1	77.65	2	Getrennt. $\lambda_V < \lambda_{Co}$.
40.38	1.2	40.31	2	Weit getrennt.
08.88	1.2	08.96	2.3	Weit getrennt.
3529.90	2—	29.92	4.5	Getrennt. $\lambda_V < \lambda_{Co}$.
20.18	2	20.20	3	Getrennt. $\lambda_V < \lambda_{Co}$.
3489.63	1	89.54	4	Weit getrennt.

Vanad und Nickel.

Die Vergleichung des Vanads mit Nickel ergiebt nur drei Coincidenzfälle, aus denen man eine Verunreinigung des ersteren Metalls durch das Letztere vermuthen könnte, nämlich die Linien 3793.76, 3609.45, 3486.05. Da jedoch eine Menge andere intensive Nickellinien im Vanadspectrum völlig fehlen, habe ich die fraglichen Linien vorläufig noch beim Vanad beibehalten.

V λ	V i	Ni λ	Ni i	Bemerkungen.
4786.70	3	86.66	3	Etwas getrennt.
4606.33	2.3	06.37	2.3	Getrennt. $\lambda_V < \lambda_{Ni}$.
4462.56	3.4	62.59	4	Getrennt. $\lambda_V < \lambda_{Ni}$.
23.32	2	23.24	1.2	Weit getrennt.
4356.10	2.3	56.07	2	Getrennt. $\lambda_V > \lambda_{Ni}$.
07.33	2.3	07.40	1.2	Weit getrennt.
4143.02	1+	43.12	1	
3973.79	2—	73.70	4	Weit getrennt.
13.03	2—	13.12	2	Weit getrennt.

V		Ni		Bemerkungen.
λ	i	λ	i	
3912.36	2.3	12.44	1.2	Weit getrennt. V-linie scharf, Ni verschwommen
3832.97	1+	33.02	2	Getrennt. $\lambda_V < \lambda_{Ni}$.
3793.76	1.2	93.75	3	Coinc.
15.62	2	15.61	1.2	Coinc. Ni-lin. schwach.
3644.05	1+	44.13	1	Weit getrennt.
09.45	1.2	09.44	2.3	Vielleicht getrennt und $\lambda_V < \lambda_{Ni}$.
3533.85	3	33.89	1	Getrennt, Ni linie breit verschwommen $i > 1$.
3486.05	1	86.04	2.3	Vielleicht getrennt.

Vanad und übrige Metalle.

Nach dieser Vergleichung des Vanads mit den von mir selbst bisher untersuchten Metallen gehe ich jetzt zu einer ähnlichen Zusammenstellung meiner Beobachtungen mit den von KAYSER und RUNGE für andere Metalle gemachten Spectraluntersuchungen über. Als Resultat dieser Vergleichungen hat es sich zunächst herausgestellt, dass mehrere dieser Metalle in ihren Spectra keine Linien von zolcher Lage oder Beschaffenheit enthalten, dass daraus auf irgend einen Zusammenhang mit Vanad geschlossen werden könnte. Es sind dies die Metalle:

Natrium	Strontium	Indium
Kalium	Magnesium	Zinn
Lithium	Zink	Blei
Rubidium	Aluminium	Arsen
Cæsium	Gold	Bismuth.

Dagegen zeigen die Metalle

Calcium	Qwecksilber	Thallium
Barium	Kupfer	Antimon
Cadmium	Silber	

einige vereinzelte angenäherte Coincidenzen mit Linien des Vanads, von denen jedoch in Anbetracht des verschwommenen Characters und der daraus folgenden erheblichen Unsicherheit der von KAYSER und RUNGE angegebenen Wellenlängen die meisten nur zufällig und auf alle Fälle nicht geeignet sein dürften um daraus irgend welche Schlüsse über etwaige Zusammengehörigkeit zu ziehen. Diese Linien sind in der folgenden Tafel nebst den von KAYSER und RUNGE angegebenen möglichen Fehlergrenzen der Wellenlänge und sonstigen Bemerkungen aufgeführt.

	λ	i	λ	i	$\Delta\lambda$	Bemerkungen.
			Ca.			
	5260.56	1	60.58	3	± 0.05	
	4586.15	1.2	86.12	6	0.10	
	4240.53	2+	40.58	3	0.10	
			Cd.			
	3729.22	1.2	29.21	3	± 0.20	Verbreitert n. Roth.
			Ba.			
	4332.98	3	33.04	3	± 0.05	Unscharf.
	4179.57	2.3	79.57	1.2	0.20	Unscharf n. Roth.
	3975.51	1	75.55	1.2	0.10	Unscharf n. Roth.
V a n a d.	3910.01	3	10.04	4.5	0.05	Umgekehrt.
			Hg.			
	4916.48	1.2	16.41	3.4	± 0.10	Unscharf n. Roth.
	3543.68	1.2	43.65	3.4	0.10	Unscharf.
			Cu.			
	4531.01	2+	31.04	4.5	± 0.10	Umgekehrt, Verbreitert n. Roth.
	3533.85	3	33.84	2.3	0.05	Verbreitert.
	3524.38	2+	24.31	1.2	0.10	Verbreitert.
			Ag.			
	4379.38	4.5	79.45	2.3	± 0.15	Verbreitert.
			Th.			
	3775.85	1.2	75.87	6	± 0.03	Umgekehrt.
			Sb.			
	3637.95	1.2	37.94	2.3	± 0.03	

Die einzigen unter diesen Linien, bei denen eine Zugehörigkeit zum Spectrum des Vanads bezweifelt werden könnte, sind diejenigen des Calciums in der ersten Gruppe. Ich habe sie jedoch beibehalten weil zwei derselben bei Calcium nur mässige Intensität zeigen und die dritte sicher der Sonnenlinie 4586.05 aber nicht der Vanadlinie entspricht. Dafür spricht auch die beim Messen der Letzteren gemachte Beobachtung, dass dieselbe eine etwas seitliche Lage in Bezug af die Sonnenlinie einnahm. Die beiden letzten Linien der Tafel zeigen allerdings eine sehr genaue Uebereinstimmung mit den entsprechenden Thallium- und Antimonlinien; da aber von den übrigen stärksten Linien dieser Metalle im Vanadspectrum nichts bemerkt worden ist, so dürfte eine Verunreinigung des Vanads durch dieselben aus der Gegenwart dieser beiden Linien kaum gefolgert werden können.

Neben den im Vorstehenden in Betracht gezogenen Metallspectra, deren Untersuchung wir Kayser und Runge verdanken, ist neuerdings eine ähnliche Bearbeitung der Spectra der Platingruppe von Kayser allein erschienen,[1] von einer wie es scheint auf diesem Gebiet

[1] Abhandlungen d. Berlin. Akad. d. Wiss. 1897. Anhang.

bisher nicht erreichten Genauigkeit der Positionsbestimmung der Linien. Diese Genauigkeit scheint in der That derjenigen im Sonnenspectrum von ROWLAND erzielten ebenbürtig zu sein, so dass die Berücksichtigung auch der dritten Stelle der Ångström'schen Einheit Berechtigung findet. Die Übereinstimmung der Kayser'schen Messungen erreicht nämlich diese Höhe nicht nur unter sich, sondern auch im Vergleich mit den entsprechenden von ROWLAND, während in den bisher bekannt gewordenen ähnlichen Messungsreihen die Einzelwerthe des einzelnen Beobachters wohl unter sich solche Schärfe darbieten können, die Endresultate aber um mehrere Einheiten schon in der zweiten Stelle von denjenigen anderer Beobachter abweichen. Unter solchen Umständen auch die dritte Stelle aufzuführen ist offenbar völlig illusorisch. Dass im vorliegenden Falle eine solche Schärfe der Messungen hat erreicht werden können, muss indessen nicht nur der überlegenen Dispersion der grossen Concavgitter, sondern auch und vielleicht vorwiegend dem besonderen Character der Spectrallinien der hier untersuchten Metalle zugeschrieben werden, die in Bezug auf ausnehmende Schärfe ihrer Linien die meisten übrigen Metalle übertreffen.

Da nun bei meinen Messungen der Vanadlinien der wahrscheinliche Fehler der Wellenlängen auf etwa $\pm$ 0.02 Ångström'sche Einheiten veransschlagt werden muss, während bei den Kayser'schen Bestimmungen in den Spectra der Platinametalle die Unsicherheit erst die dritte Stelle betrifft, so habe ich bei der Vergleichung meiner Beobachtungen mit den seinigen die Grenze der angenäherten Coincidenzen enger gezogen und nur diejenigen Linien berücksichtigt, deren Wellenlängen um höchstens $\pm$ 0.05 Å. E. von einander abweichen, da es wohl ziemlich sicher sein dürfte, dass Linien mit grösserer Differenz der Wellenlängen wirklich getrennt und daher von einander unabhängig sind. In der Weise gelange ich zu der folgenden Zusammenstellung:

	λ	i	λ	i		λ	i	λ	i
			Pt.			4197.77	2—	97.75	2.3
	3687.61	2.3	87.58	2+		82.77	2.3	82.81	1—
	3505.83	1+	05.85	1—		21.13	1+	21.15	1+
						18.73	2	18.68	1+
			Pd.			3950.37	2—	50.37	2.3
	5668.61	2.3	68.60	1+		42.16	2	42.21	2.3
	4406.80	4.5	06.76	3		3890.34	3	90.35	2.3
Vanad.					Vanad.	3790.62	1.2	90.65	3
			Ru.			55.85	1+	55.86	1+
	5725.90	2	25.90	2.3		3676.86	3	76.82	2—
	5657.11	1+	57.13	1+		72.54	2	72.53	1+
	4833.17	2	33.16	1+		71.37	2—	71.36	1+
	14.28	2.3	14.33	1—		05.83	1.2	05.79	1.2
	4531.01	2+	31.03	2+		3493.34	1	93.38	1+
	4428.67	3	28.62	2+					
	26.17	3	26.18	1—				*Rh.*	
	4341.15	3	41.20	1+		5626.27	2.3	26.25	1+
	4297.86	2.3	97.89	4.5		05.20	2.3	05.21	1—
	26.78	2	26.82	1—		4922.60	1.2	22.63	1+

Vanad	λ	i	λ	i
	4506.77	2—	06.82	1—
	3888.50	2	88.47	1+
	28.66	3.4	28.62	1+
	18.37	3	18.35	3
	17.98	2	17.99	1—
	06.93	2	06.92	2.3
	3775.85	1.2	75.86	1.2
			Os.	
	4738.51	1.2	38.51	1.2
	4529.80	2.3	29.85	1+
	4400.74	4	00.75	1—

Vanad	λ	i	λ	i
	4097.09	1.2	97.09	1—
	15.20	1+	15.20	1—
	03.70	1.2	03.65	1+
	3963.77	2	63.77	2.3
	30.19	2.3	30.15	1—
			Ir.	
	4261.37	2	61.41	1+
	57.54	2	57.53	1+
	4051.11	2.3	51.07	1+
	48.77	1.2	48.78	1—
	3952.10	2	52.10	1+

Die Zahl der angenäherten Coincidenzen ist namentlich bei Ruthenium grösser als man mit Rücksicht auf die angenommenen engen Grenzen der Wellenlängendifferenz hätte erwarten können. Ob hier nun wirkliche Coincidenzen und in einzelnen Fällen Verunreinigungen des Vanadspectrums durch diese Metalle vorliegen oder nicht würde erst durch directe Vergleichung der resp. Spectra sicher zu entscheiden sein. Nach den Intensitätsschätzungen zu urtheilen ist in vielen Fällen, vielleicht in der Mehrzahl derselben, sogar das Umgekehrte ebenso wahrscheinlich, oder dass die Platina-metalle durch Vanad verunreinigt gewesen sind.

RESULTATE DER BEOBACHTUNGEN.

Auf Grund des im Obigen Mitgetheilen habe ich aus meinen Messungen den folgenden Catalog der dem Vanad zuzuschreibenden Spectrallinien abgeleitet. Die letzte Columne desselben enthält die entsprechenden Bestimmungen Rowlands, wobei jedoch diejenigen Linien seines Catalogs, welche bei mir nicht vorkommen, in der Columne »Bemerkungen» mit der Bezeichung *R.* aufgeführt worden sind.

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.
——	**5853**.90				
5850.60		1	—		
46.56		2	—	v.	
39.34		1	—		
——	**5831**.83				
30.97		2	—	v.	
17.80		2—	—		
17.33		1.2	—		

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
——	**5809**.44					
5807.40		2—	—			
00.17		1.2	—			
——	**5791**.21					
5788.85		1.2	—			
86.42		2	—		86.41	1
84.64		2	—		84.65	1
83.76		1+	—		83.76	1

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.		Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
5783.14		1	—				5605.20*		2.3	—		05.19	4
82.85		1+	—		82.85	1	04.91*		1	—		04.88	1
76.95		2	—	v.	76.93	1.2	04.44*		1.2	—		04.44	1
72.66		2+	—	s.	72.66	2	——	**5603**.10					
——	**5763**.21						01.63		2—	—	R. 98.05 1	01.63	1
61.70		1.2	—		61.67	1—	5593.22		1.2	—	R. 94.73 1	93.21	1
52.99		1.2	—		52.99	1	92.67		3	—		92.67	4
50.90		1.2	—				88.71		1.2	—		88.71	1
49.13		2	—	s.			86.26		2	—		86.23	1
47.98		1	—	s.			85.00		1.2	1+	V?	84.98	1
43.67		2 3	—		43.67	5	84.75		2.3	—	84.60 1	84.75	5
——	**5742**.07						——	**5569**.85			R. 76.75 1 67.70 1		
37.28		3	—		37.31	5	61.92		2—	—	66.16 1	61.90	1
34.26		2	—		34.25	2	59.00		2—	—		58.99	1
33.63		1+	—				57.71		1+	—			
33.34		1.2	—		33.34	1	48.41		1+	—		48.40	1
31.48		3.4	—				47.31		2.3	—	45.10 1	47.31	4
27.90		2.3	—		27.90	5	46.18		2—	—	42.95 1 35.66 1	46.16	1
27.25		4	1.2		27.30	10	——	**5513**.21			R. 35.08 1		
25.90		2	—	s.	25.88	3	11.41		1.2	—	34.06 1 17.44 1 15.30 1	11.41	1
16.49		1.2	—		16.46	1							
——	**5709**.69						07.97		2.3	—	08.86 1		
09.25		1 2	—		09.20	1	05.13		1.2	—	07.74 1 06.10 1	05.10	1
07.26		3.4	1.2		07.24	10	——	**5497**.73					
03.83		3.4	1		03.83	10	5490.22		1.2	—		90.18	1
5698.74		4	?		98.76	1	88.18		2+	—		[1]88.31	4
——	**5688**.43						5487.48		1.2	—		87.45	1
5688.02		1+	—		88.00	1	——	**5477**.13					
83.47		1.2	—		83.45	1	71.56		1+	—		71.56	1
——	**5675**.65						68.05		1	—		68.03	1
71.10		3.4	?	Vielleicht eine feine ⊙-lin.	71.09	10	64.30		1—	—			
68.61		2.3	—		68.61	5	——	**5463**.17			R. 55.03 1 *Ru.* hat 55 02 3.4		
57.67		2.3	—		57.69	5	58.39		2—	—			
57.11		1+	—		57.12	1	——	**5447**.13					
——	**5655**.71						43.50		1+	—		43.47	1
46.36		2.3	—		46.35	5	37.93		1.2	—		37.89	1
35.76		1.2	—		35.74	1	——	**5434**.74					
—		—	—		34.14	1	34.43		2	—		34.41	4
——	**5634**.17						21.96		1	—	R. 24.28 2 (Fe).		
32.73		1+	—		32.70	1	20.32		1—	—			
27.86		3.4	1		27.89	7	18.33		1.2	—		18.32	1
26.27		2.3	—		26.27	7	15.51		2.3	?	Fe hat 15.42	15.48	5
25.16		2	—		25.12	4	——	**5415**.42					
24.80		2.3	—		24.85	7	02.17		2.3	—		02.15	5
22.34		1.2	—	R. hat auch 24.45 1	22.32	1							

* Der Asterisk bedeutet dass die betreffende Wellenlänge aus der folgenden ⊙-lin. abgeleitet ist.
[1] Ob nicht ein Druckfehler für 88.21?

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
5398.13		1.2	—			
——	**5397**.35					
88.56		1.2	1	Coinc. m. einer feinen ⊙-lin.	88.53	1
85.39		2	—			
83.68		2—	—	⊙ hat 83.58 (Fe).	83.65	1
——	**5333**.09			R. 58.62 3 / 38.81 1		
30.65		1	—		30.62	1
29.05		1	—	Hier liegen mehrere feine Linien. V?		
——	**5307**.55					
02.40		1	—			
——	**5288**.71			Mehrere feine Linien.		
5287.88		1	—			
82.75		1	—			
72.92		1	—			
71.28		1	—		71.12	1
——	**5270**.50					
66.33		1	—			
61.20		1	—		61.15	1
60.56		1	—		60.53	1
——	**5242**.66			R. 58.31 1		
41.06		2	—	ss.	41.06	3
40.40		1	—		40.36	2
34.31		2	—	ss.	34.25	7
33.91		1	—		33.90	2
25.97		1.2	—		25.92	3
——	**5217**.56					
16.80		1.2	—		16.77	1
13.87		1+	—		13.84	1
12.47		1—	—		12.40	1
07.89		1—	—		07.84	1
5206.82		1+	—		06.79	1
——	**5202**.48			R. 00.52 1 / 97.22 1		
5195.58		2	2		95.56	2
95.01		2+	—		95.02	6
93.82		1+	—		93.80	1
93.18		2	2	V?	93.18	5
92.22		1	—		92.19	1
——	**5183**.79					
83.07		1—	—		83.03	1
81.01		1	—		80.93	1
79.35		1	—		79.28	1
78.75		1	—		78.73	1
77.03		2—	—	R. 76.68 1	76.96	1
72.35		1—	—	74.71 1	72.28	1
70.15		1+	—		70.11	1
67.04		1	—	R. 69.13 1	66.96	1

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
——	**5165**.59					
5165.14		1	—		65.07	1
59.56		2	—		59.52	2
57.27		1—	—	R. 59.44 2		
48.95		2	?	Ob ⊙-linie?	48.89	4
——	**5141**.92					
39.74		2—	?	Ob ⊙-linie?	39.70	2
38,58		2+	—		38.60	4
28.71		2.3	—	R. 37.77 1	28.71	7
——	**5109**.82					
05.37		1.2	—		05.32	2
——	**5064**.83					
5064.32		1.2	—		64.30	1
60.91		1	—	R. 51.78 1 / 47.84 1	60.83	1
14.83*		—	—		14.81	4
——	**5014**.42					
02.54		2+	—		02.51	2
4943.04*		1.2	—			
——	**4942**.66					
33.82		1+	—		33.79	1
32.24		2	1		32.21	3
25.83		2.3	—	⊙ hat 25.75 (Ni).	25.84	7
——	**4924**.95					
22.60		1.2	—	R. 19.17 1	22.54	1
16.48		1.2	—	R. 13.28 1	16.44	1
08.92		1	—	R. 07.05 1	08.88	1
06.06		1	—			
05.10		1.2	—		05.05	3
04.59		3	2	Dpl. Coinc. exakt?	04.58	5
——	**4903**.49					
00.84		2.3	—		00.82	3
4894.43		2—	—		94.40	3
91.81		2—	—	⊙ hat 91.68 (Fe).	91.77	3
91.43		1.2	—		91.41	2
——	**4890**.94					
90.32		1.2	—		90.26	1
87.02		2—	—		86.99	2
85.86		2—	—		85.83	2
81.75		4	1.2	R. 82.36 2	81.75	10
80.77		2.3	—		80.75	6
75.66		4	1+		75.67	10
71.46		2—	—	R. 73.17 1 ⊙ hat 71.51 (Fe) keine Coinc. mit V. R. 70.33 1	71.45	3
64.93		4	?	Coinc.?	64.94	10
62.83		2	1	Coinc.?	62.80	4

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
—	**4859**.93					
4859.34		2—	1	⊙ hat 59.32 Coinc.? R. 58.81 2, 57.24 1, 54.11 1, 52.15 1		
51.65		4	1.2		51.69	10
48.98		1.2	—	R. 49.46 1, 49.26 1	49.00	1
43.16		1.2	—	R. 46.80 1	43.19	2
33.17		2	—	R. 35.04 1, 34.26 1, 34.00 1	33.21	3
32.59		3	1		32.62	8
31.80		3.4	1+		31,84	8
30.86		1.2	—		30.88	1
29.00		1.2	—	R. 29.43 1	29.01	1
27.62		3.4	1		27.64	10
—	**4824**.32			R. 23.03 1		
19.22		1.2	—		19.22	2
07.70		3.4	1	R. 08.84 1	07.74	10
—	**4805**.25			R. 03.24 1, 02.37 1		
4799.94		2+	1.2		99.97	4
99.20		1+	—		99.21	1
98.12		1.2	—		98.15	1
97.07		3	1		97.12	8
95.27		2—	—		95.29	2
93.10		2	—	R. 94.73 1	93.13	2
86.70		3	3	R. 89.10 1	86.71	7
84.65		2	—		84.66	5
—	**4783**.60			R. 81.51 1		
76.70		2+	1.2		76.64	5
76.54		3	1.2			
73.25		1.2	—		73.26	1
72.74		1+	—		72.78	1
66.80		2.3	1	R. 69.21 1	66.84	7
65.84		1.2	—		65.86	1
58.92		1.2	—	R. 64.22 1, 59.21 1	58.94	1
57.68		2.3	—	⊙ hat 57.77 (Fe).	57.69	4
57.55		2	—			
—	**4754**.23					
54.13		2.3	—	⊙ hat 54.23 (Mn). R. 52.04 1		
51.75		2	—		51.76	5
51.45		1	—		51.46	1
51.16		2+	—		51.21	5
48.70		2+	—		48.72	5
47.30		1.2	—		47.31	1
46.81		2	—		46.83	5
42.79		2	1		42.82	5
39.79		1	—		39.85	1

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
4738.51		1.2	—	Os. hat 38.51 1+.	38.51	1
37.91		1+	—		37.92	1
32.12		1.2	—		32.11	1
31.74		1.2	—		31.74	1
31.42		1.2	—		31.44	1
30.57		2	—		30.57	2
29.73		2+	—		29.72	5
28.85		1+	—		28.84	1
—	**4727**.63			R. 24.07 1		
23.65		1	—		23.63	1
23.06		2.3	—		23.06	4
21.70		2.3	—		21.70	4
21.42		1.2	—		21.44	1
17.85		2.3	—		17.87	5
16.36		1.2	—		16.38	1
16.08		2+	—		16.08	4
15.61		1.2	—	R. 15.49 1 (Ti)	15.65	1
14.28		2.3	1.2			
13.61		1.2	—		13.64	1
10.74		2.3	—	R. 09.13 1, 08.40 1	10.75	5
07.62		2	2		07.63	3
06.75		2.3	1.2		06.76	5
06.34		2.3	—		06.36	5
05.26		2	—		05.28	3
—	**4703**.18			R. 02.69 1		
4699.52		2—	2		99.51	2
90.45		1	—		90.44	1
88.24		1	—			
87.10		2.3	—		87.10	5
84.64		2	—		84.63	3
—	**4683**.74					
82.09		1+	1.2	V?		
81.07		1.2	1	Coinc. unsicher.	81.07	1
79.95		1.2	—		79.96	1
79.65		1	—			
73.83		1	—		73.84	1
72.48		1	2	V?		
70.66		4	—		70.67	8
69.50		1+	1		69.49	1
—	**4668**.30					
66.33		2+	1.2	⊙-lin. dpl. Coinc. m. d. Comp. n. V. R. 63.31 3, 62.61 1		
62.02		1	—			
61.01		1	—			
57.17		1	1.2		57.14	1

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
4655.47		1	?	Vielleicht feine ⊙-lin.	55.41	1
54.84		1.2	—	⊙ hat {54.91 Cr. 80 Fe.		
53.15		1	—		53.11	1
49.08		1.2	1		49.07	2
——	**4648**.83					
48.08		1	1.2	Coinc. unsicher.	48.05	1
46.59		2.3	?	⊙-lin.?	46.57	8
46.17		1+	—		46.16	1
44.64		2—	?	⊙-lin.?	44.62	2
40.92		2	—		40.91	6
40.25		2	—		40.24	5
36.34		1.2	—		36.34	1
35.35		2.3	?	⊙-lin.?	35.35	7
30.24		1	—		30.24	1
——	**4629**.51					
26.67		2+	1.2		26.67	4
24.62		2+	?		24.58	4
21.43		1	—		21.43	1
19.97		2.3	?	⊙-lin.?	19.90	0
19.85		2	?	⊙-lin.?		
18.00		1	—			
17.03		1	—			
16.18		1	—		16.19	11
14.08		1	1.2	V? R. 13.98 1	14.09	1
11.92		2—	—			
11.10		1.2	—		11.10	1
09.84		2	—		09.82	4
07.40		1.2	—	R. 08.63 1	07.39	1
06.33		2.3	—		06.32	4
——	**4602**.18					
00.34		1.2	—			
4594.27		4.5	2		94.22	10
91.39		2.3	—		91.41	5
88.94		1+	—			
86.54		4.5	1		86.55	8
86.15		1.2	—	Neben d. ⊙-lin. 86.05 (Ca).		
83.96		2	—	Neben d. ⊙-lin. 84.02 (Fe). R. 81.41 1	83.97	2
80.57		4	2		80.56	8
79.38		2.3	—		79.37	2
78.92		3	?	⊙-lin.?	78.91	5
——	**4578**.73					
77.36		4	1		77.35	7
71.96		3	—		71.96	5
70.60		2	—			

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
4564.76		1+	?	⊙-lin.?	64.76	1
60.90		3	?	⊙-lin.?	60.89	7
——	**4554**.21					
53.25		2.3	—			
52.05		2	—	R. 52.73 5	52.02	2
49.81		3	2.3		49.82	8
45.57		3.4	?	⊙-lin.?	45.57	10
41.57		1	—			
40.18		2	—	Vielleicht ⊙-lin.	40.18	4
37.84		2	1		37.83	4
——	**4534**.95			R. 34.11 3		
30.97		2+	—	Neben d. ⊙-lin. 30.91 (Cr).	30.97	3
29.76		2.3	—			
29.47		2+	—		29.48	2
28.66		2—	—			
28.16		2.3	—		28.17	3
25.31		2+	2.3	s. Auch Fe.	25.34	2
24.38		3	—		24.38	5
20.67		1.2	—	v.	20.68	2
20.31		2—	—	v.	20.33	2
17.77		2	2	17.70 Fe.	17.74	3
15.74		1.2	—		15.73	1
14.36		2.3	2	Auch Fe, Co.	14.36	4
13.79		2	—		13.79	2
11.64		2	—		11.61	2
09.49		2	1	⊙-lin. äusserst schwach.	09.46	2
——	**4508**.46					
08.11		1	—			
06.77		2—	1		06.74	1
06.41		1.2	—			
06.30		2	—			
02.12		3	—	R. 01.41 1 (Ti)	02.12	4
01.01		2—	—	v.	01.00	2
4497.57		2	—		97.57	5
97.03		2+	3			
96.26		3	—	Neben d. ⊙-lin 96.32 (Ti).	96.23	5
95.16		1.2	?	⊙-lin.?		
——	**4494**.73					
91.66		1	—		91.65	1
91.35		1.2	—	s.	91.34	2
90.95		2.3	2	ss.	90.98	4
89.06		3.4	2		89.10	7
86.44		1	—			
80.20		2.3	—	ss.	80.21	3
——	**4476**.19					
76.06		2	—			

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
4474.89		3.4	—		74.90	7
74.21		3	—		74.21	7
69.88		3.4	—	R. 70.87 1	69.87	7
68.94		2	—		68.93	3
68.19		2.3	?		68.17	3
67.04		2	2	Coinc. unsicher. R. 65.67 3		
62.56		3.4	—	Neben ⊙-lin. 62.62 (Ni). R. 60.85 4	62.53	10
60.46		4.5	2.3	⊙-lin. breit. Gruppe?	60.46	10
59.93		4	2	R. 58.91 1	59.92	8
57.97		2.3	1			
57.65		3.4	3	⊙-lin. dpl. {57.71 Mn. 60 Ti, V.	57.63	3
56.68		2	—		56.67	3
—	**4456**.05			R. {56.07 1 Ca. 54.94 Ca.		
52.91		2	?	⊙-lin.?		
52.19		4	1		52.18	8
51.09		2+	1.2		51.07	4
49.77		2.3	—		49.74	4
44.40		3.4	1	Auch schwache Ti-lin.	44.38	3
43.52		2	—		43.51	4
41.88		3.4	1.2	Coinc.? Auch schwache Ti-lin.	41.85	2
38.02		3.4	1		38.00	7
36.31		3.4	1		36.31	7
—	**4435**.85					
34.80		2+	—			
30.68		2	—			
29.95		3	—			
28.68		3	1		28.68	5
26.17		3	1			
25.86		2	1			
24.74		1.2	1	R. 25.59 1 Ca.	24.74	4
24.10		1.2	—		24.08	2
23.41		1.2	—	}	23.37	8
23.32		1.2	—	}		
22.40		1.2	1			
21.73		3	1	⊙-lin. äusserst schwach.	21.74	10
20.08		2.3	—			
16.63		3	1+		16.63	5
12.30		2	—	ss.	12.30	4
08.67		4.5	3	⊙-lin. dpl. {08.67 — V. 58 — Fe.	08.66	5
08.36		4	2		08.37	5
—	**4407**.85					
07.85		4.5	3	⊙ dpl. {Comp. n. R. = Fe, Ti. » » V. = V.	07.80	8

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
4406.80		4.5	2		06.80	8
05.20		2.3	1	R. 06.28 8 ss.		
03.86		1·2	—		03.83	4
00.74		4	1.2		00.74	10
4395.40		4.5	2	R. 97.39 1	95.38	10
94.98		1.2	1			
94.01		2—	1		94.00	4
93.26		2—	?		93.26	3
92.24		2	1		92.23	4
91.84		1.2				
—	**4391**.15					
90.79		1	—			
90.13		4.5	2	Umgekehrt.	90.14	7
87.40		1.2	—			
84.87		4.5	2.3		84.87	1
84.37		1	—			
84.07		1	—			
80.69		2—	—	R. 81.19 1	80.72	4
79.38		4.5	2.3	Umgekehrt.	79.39	1
78.06		2—	—	v.		
76.25		1	—			
75.47		2	1			
73.99		2	1	⊙ dpl. {74.05. 73.95.	73.98	3
73.40		2	1		73.38	6
—	**4369**.94					
69.25		1+	—			
68.76		1.2	1		68.76	4
68.25		2+	1			
67.24		1+	—			
65.92		1.2	—			
64.37		2	1+		64.38	4
63.69		2	?		63.69	4
63.48		1	1.2			
61.57		1.2	—			
61.18		1+	—			
60.75		1.2	—			
57.82		1	—			
57.60		1.2	—			
56.10		2.3	1.2		56.10	4
55.09		2	?	⊙-lin.?	55.14	4
53.02		3.4	1		53.04	18
—	**4343**.39					
43.00		2—	—			
42.36		1.2	—			
41.15		3	1		41.16	10

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
4336.29		1.2	—			
34.23		1.2	—			
32.98		3	1		32.98	10
32.56		1.2	—			
30.18		3	1			
22.51		1+	—			
20.46		1+	—			
——	**4318**.82			R. 18.80 2 Ca.		
16.02		1	—			
14.06		1.2	—			
12.56		1+	—			
09.95		3	?		09.95	7
09.69		1.2	—			
07.33		2.3	—			
06.35		2.3	—			
03.70		2—	?	R. 99.24 1	03.70	2
4298.17		2.3	2	V? Auch unbedeutende Fe-lin. Zwischen 03.7 und 98.2 dichte Liniengruppe, theilweise Ti.		
97.86		2.3	—		97.84	7
96.28		2.3	—		96.27	7
——	**4293**.25					
91.97		3	—		91.98	1
91.46		2—	—			
87.97		2	—			
86.57		2	—	⊙ hat 86.63 v.		
84.19		3	—		84.21	5
83.06		2	—			
79.12		1.2	—			
77.12		3	1		77.10	7
——	**4271**.92					
71.71		3	—		71.71	17
70.49		2	—			
69.92		2	1	⊙-lin dpl. {70.02. 69.90.		
68.78		3	1		68.79	0
67.50		1.2	1.2			
65.28		2	—	Breit, dpl.?		
62.32		2	—		62.31	4
61.37		2—	2			
59.46		2	1+	ss.	59.45	4
57.53		2	1	ss. ⊙-lin. Spur.	57.52	4
55.60		1.2	—			
53.02		1.2	—			
51.45		1	?	⊙ 51.49.		
——	**4250**.96					

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
4247.46		1+	?	Coinc.?		
41.48		2	—			
40.53		2+	2	Fe. 40.56. Getrennt.		
40.25		2	1	Coinc.?		
39.12		1.2	—			
35.90		2.3	1		35.91	4
34.70		2.3	1		34.67	7
34.12		3	—		34.15	7
33.09		3	1.2		33.01	7
32.62		3	1—		32.60	7
29.87		2	—			
27.90		2	1			
——	**4226**.89			R. 26.87 4 Ca.		
26.78		2	--	Im Schatten d. Ca-lin. 26.90.		
25.40		1	1		25.37	1
24.30		2	—			
22.49		1+	—			
21.17		1+	—	v.		
19.65		1.2	—			
18.86		2	2	ss.		
16.52		1	?			
11.02		1	—			
10.55		1	—			
09.98		2.3	1.2		10.00	5
05.23		1+	1.2		05.20	2
04.67		1	?			
02.52		1+	1		02.51	2
——	**4202**.19					
00.35		2—	—			
4198.78		2—	2.3	s.		
97.77		2—	1	s.		
97.45		1	1			
94.17		1+	—			
91.70		2.3	—			
89.99		2.3	—	In einer Gruppe schwacher ⊙-lin. Coinc.?	90.01	—
87.82		1	—			
86.95		1	—			
——	**4185**.06					
83.59		1+	1.2			
83.43		1+	—	R. 83.07 4		
82.74		2.3	—		82.73	1
82.23		1.2	—			
80.99		1	2	V?		
79.53		2.3	2			

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
4177.25		2—	1			
77.02		1	—			
76.83		1—	—			
75.30		1	1.2			
74.18		2	1		74.15	1
71.45		2	—			
69.40		1.2	1	Nebenbei Ti 69.46.		
62.51		1	—			
60.57		1+	—			
59.84		2.3	1		59.82	2
58.14		1+	—			
——	**4157**.95					
56.00		1.2	?			
55.39		1	—			
53.49		1.2	?			
52.81		2—	—			
51.52		1	—			
50.84		2—	—			
49.02		1.2	—			
43.02		1+	?			
42.75		1.2	1.2			
41.96		1.2	—			
39.39		2	—			
36.52		2	—			
36.25		2	—			
34.61		3.4	2.3	⊙-lin. dpl. {34.60. 50.	34.62	7
33.92		2—	—			
32.13		3.4	2.3	⊙-lin. dpl. {32.22 Fe. 13 V.	32.12	6
31.32		1	—	Mn hat 31.26; getrennt.	31.30	1
29.00		2	?			
28.25		3.4	2.3		[1]28.15	7
24.23		2—	—		24.20	1
23.65		3	2			
——	**4121**.97					
21.13		1+	?			
20.69		2	?		20.66	2
19.58		2	1		19.58	3
18.73		2	—	Neben 18.71 (Fe).		
18.34		2.3	?	Coinc.?	18.32	1
16.85		1.2	1.2			
16.64		3	1.2		16.63	9
15.32		3.4	2		15.31	7
14.69		1.2	—			

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
4113.65		2.3	—		13.64	3
12.47		1.2	1.2			
11.92		4	2.3		11.92	5
09.94		3.4	2.3	Dicht neben d. Fe-lin. 09.95.	09.91	7
08.36		2	?			
07.64		1.2	2.3	Dicht neben d. Fe-lin. 07.65.	07.60	1
05.32		3	1.2			
04.92		2	1			
04.55		2	—		04.52	2
——	**4103**.10					
02.32		3	1	Ob ⊙-lin.?	02.29	3
4099.93		3.4	2		99.92	7
98.54		2	1—	Ob ⊙-lin.?	98.51	1
97.09		1.2	1			
95.64		3	1		95.61	5
94.42		2	—			
93.65		2+	—			
92,83		3	2			
92.54		2	2	Auch bei Mn.	92.53	2
92.09		1.2	—			
90.70		3	1.2		90.70	5
——	**4083**.77			R. 77.85 1 Sr.		
72.30		2+	—		71.66	2
71.67		2.3	2			
67.90		1.2	—			
64.09		2.3	—		64.06	2
——	**4062**.60					
60.97		1+	?	Coinc.?		
57.21		3	—	R. 57.96 1 Pb.	57.21	2
52.60		1	—			
51.48		2.3	1		51.48	4
51.11		2.3	?	Vielleicht ⊙-lin.		
48.77		2—	—			
47.05		1+	—			
42.78		2+	?	Vielleicht ⊙-lin.	42.76	1
41.72		2	—	Neben ⊙-lin. 41.80.		
40.46		1+	—			
36.93		1	1			
35.77		2	2.3	{35.88 Mn. 77 V. 73 Co.		
——	**4034**.64			R. {34.62 2 Mn. 33.19 3 Mn.		
33.01		1+	—			
32.62		1.2	1.2	Coinc.?		
31.98		2	—	Zwischen {32.12 Fe. 31.94 Mn.	31.96	1

[1] Druckfehler; soll sein 28.25.

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
4031.37		1.2	1			
30.04		1.2	1—	⊙-lin.?		
25.46		1+	—			
23.50		2	2	Hier mehrere feine Linien. R. 22.04 1	23.51	1
15.20		1+	—			
11.45		1+	—			
09.94		1	—			
05.86		2+	2		05.84	1
——	**4003**.92					
03.70		1.2	—			
03.10		1.2	1.2			
00.24		1	—			
3998.87		3	—	Neben 98.80 (Ti).	98.85	3
97.30		1.2	1.2			
92.95		3	2		92.92	3
90.71		3	1		90.69	5
88.97		2	—			
84.75		2	2			
80.66		2—	—			
79.59		2—	—		79.54	1
79.30		2—	—			
——	**3977**.89					
73.79		2—	?			
73.49		1	1			
72.10		1+	—			
68.24		2—	—	R. 68.59 1 Ca		
63.77		2	2	V-lin. etwas nach Violett verschoben. R. 61.65 5 Al		
52.09		2	2	s. Ir hat 52.10 1+.	52.07	1
50.37		2—	—			
——	**3950**.10			R. 44.13 3 Al		
43.77		2.3	—			
42.16		2	—			
41.40		1.2	2	Coinc?		
40.75		1	—			
39.48		2—	—			
38.35		2—	—			
37.68		2—	—			
36.42		2	—			
35.28		2.3	—			
34.16		3.4	—			
31.50		2	—	R. 33.77 3 Ca		
31.40		1+	—			
30.19		2.3	—			

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
3925.36		2+	2		25.35	3
24.84		2.3	—	Begleiter n. Roth.	24.77	3
——	**3924**.67					
22.58		2.3	1		22.55	3
22.05		2—	—		22.02	1
20.65		1.2	—			
20.15		1	—			
16.55		1.2	2	V? R. 19.60 1 R. 14.44 1		
13.03		2—	—			
12.36		2.3	—	ss.		
10.95		2	—	s.		
10.01		3	2.3	V dpl. auch ⊙-lin.	09.99	5
06.89		2	2	s. Auch schwache Fe-lin.		
04.63		1	—			
03.42		1.2	1			
02.71		1+	—			
02.40		3.4	2		02.37	7
01.30		2.3	—	v.		
00.33		2.3	—	v.		
3899.30		1+	2	⊙-lin. dpl. 99.30 Fe. 17 V.		
98.15		3	3	v. matt. ⊙-lin. stark dpl. Fe.	98.08	1
——	**3897**.60					
97.22		2	—			
96.29		2	—		96.26	2
94.19		2	2	s. ⊙-lin. enge Dpl.		
93.03		3	—	ss. Neben d. ⊙-lin. 93.00. R. 92.47 4		
91.27		2+	—	v. breit, matt.		
90.33		3	1.2	ss.	90.30	4
88.50		2	—	v. matt.		
88.23		1+	—			
86.72		2	—	s.	86.69	2
85.91		1+	1.2			
85.00		1	1			
84.60		1.2	—			
84.04		1.2	—			
79.82		1.2	—			
76.21		2.3	2	Auch unbedeutende Fe-lin.		
76.05		2+	1.2			
——	**3875**.22					
75.22		3	2		75.20	5
73.80		1+	—			
71.23		2	?	Fällt in einen breiten Streifen d. ⊙.		

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
3870.72		1+	—			
67.77		2.3	2			
67.50		1	—			
65.02		3.4	2	Am Rande d. ⊙-lin.	64.98	5
64.02		2—	—	s.		
62.37		2—	—	s.		
59.51		1.2	—			
58.83		1.2	1.2	Coinc.?		
——	**3856**.52					
56.00		4	2		55.96	7
55.50		3	2	⊙-lin. breit, dpl.? tripl.?	55.49	4
52.27		1	—			
51.32		1.2	—			
49.48		2	—		49.43	2
47.46		2.3	?	s. ⊙ hat eine Gruppe feine Linien Coinc.?	47.45	3
45.03		1	—			
44.58		2.3	1	s.	44.57	4
42.03		2—	?	Coinc.?		
40.88		3	1		40.87	6
40.56		2.3	—	Am Rande d. ⊙-lin. 40.60 (Fe).		
40.27		2—	?			
39.53		2	—			
39.12		2	1	Coinc.?		
——	**3836**.65					
36.20		2—	—			
35.70		2—	—			
33.36		1+	1			
32.97		1+	—			
28.67		3.4	2		28.68	7
24.12		2—	—			
23.35		2+	1			
23.00		2+	1.2		23.01	2
22.14		2.3	1.2			
21.63		2+	1		21.61	4
20.41		1+	—	R. 20.59 2 Im Schatten einer starken ⊙-lin.		
20.10		2+	—		20.09	4
18.37		3	2		18.37	5
18.12		1.2	—			
17.98		2—	1			
——	**3815**.98					
15.65		2	—			
13.63		3	?		13.61	4
08.64		2.3	1	ss. R. 08.14 4		

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
3807.64		2+	?	Neben d. ⊙-lin. 07.68. R. 07.42 2	07.63	3
06.93		2	—	Neben d. ⊙-lin. 06.86.		
04.05		1.2	—			
03.92		1.2	—			
03.62		2.3	1		03.61	3
00.05		2.3	?		00.05	3
3795.12		3.4	?	Am Rande einer starken ⊙-lin.		
——	**3794**.01					
93.76		2—	2			
90.62		1.2	2	Ru hat 90.65 3 Cr » 61 2	90.59	1
90.46		2.3	—		90.45	2
87.68		1	—			
84.84		1	—			
82.70		1	—			
81.54		1.2	—			
79.80		1.2	—			
78.83		2.3	2	ss.	78.81	3
78.48		1	2	V?		
77.63		1	2	V?		
77.31		1	—			
76.31		1.2	—	matt.		
75.85		1.2	—	matt.		
75.34		1.2	1	matt. Coinc.?		
74.27		1+	—			
71.87		1,2	—	v. oder dpl.		
71.31		1	1			
71.11		2	1			
70.68		1	—			
——	**3770**.13					
69.23		1+	?	Vielleicht ⊙-lin.		
64.96		1	—			
63.30		2-—	—			
60.96		1	—			
60.40		1	1	V?		
56.18		1	—	Am Rande d. ⊙-lin. 56.21 (Fe).		
55.85		1+	—			
53.44		1+	—			
51.94		1+	1.2			
51.02		2—	1.2	ss.		
48.14		1+	—			
——	**3747**.10					
46.02		2—	—	ss. Am Rande d. ⊙-lin. 46.06 (Fe).		

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
3741.65		1.2	1.2		41.63	1
40.38		1.2	2		40.37	1
38.93		2—	—		38.90	1
38.15		1.2	—		38.13	1
34.59		1.2	—			
32.88		2	1.2	ss.		
29.22		1.2	—			
27.49		2	2			
23.52		1.2	—			
22.76		2	?			
22.27		1	1+		22.33	1
22.15		1+	—		22.14	1
——	**3720**.09					
15.62		2	2	ss. Ni 15.61 1.2.		
14.12		1	—			
08.88		1.2	—	ss.	08.85	1
05.19		2.3	1	R. 06. 17 Ca, Mn	05.17	5
04.85		3	1.2		04.83	7
03.71		3.4	2	R. 04.66 1 Auch schwache Fe-lin.		
3696.00		3	1		95.99	4
95.48		2.3	1		95.45	1
——	**3695**.19					
92.36		3	1		92.36	3
90.41		2.3	1		90.41	3
88.22		2.3	1.2		88.21	3
87.61		2.3	3	Auch starke Fe-lin., Andere Fe-linien in der Nähe kaum sichtbar.		
86.40		2	2		86.39	3
84.83		1.2	—			
				R. 83.60 1 Pb		
83.26		3	—	Fe 83.23.	83.24	3
80.26		3	?	⊙-lin.?	80.21	1
——	**3680**.06			R. 80.05 1		
76.86		3	—	v. Ru 76.82 2.	76.81	1
75.85		2.3	1.2	ss.	75.84	2
73.55		3	1	v.		
72.53		2	—	v. Ru 72.53.	72.52	1
				R. 71.84 1		
71.37		2—	1	Coinc.?		
69.57		1.2	1	⊙ hat eine Tripl.; die mittlere stark = Fe.		
67.87		2.3	—	v.	67.84	1
65.30		2	—		65.26	1
63.73		2.3	—		63.69	1
——	**3653**.64					
49.13		2—	1.2		49.06	1

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
3645.77		1.2	—			
44.88		1.2	1.2	ss. ⊙-lin. enge Dpl. viol. Comp.		
44.05		1.2	—		44.04	1
41.28		1.2	—			
40.25		1+	—			
				R. 39.72 1 Pb		
39.21		1.2	1		39.16	1
38.57		1	—			
37.95		1+	1			
36.09		2	—			
——	**3623**.33					
22.82		1	1	V?		
19.10		1	—	ss.		
16.91		1+	—			
09.45		1.2	2	ss. V? Auch schwache Ti-lin.		
——	**3609**.02					
05.75		1.2	—			
00.20		1+	—		00.17	1
3593.48		2	2		93.52	1
92.71		1+	—			
92.15		2+	2		92.16	1
89.91		2+	2		89.89	1
83.84		1+	2		83.84	1
——	**3583**.48					
83.00		1+	—		82.95	1
81.00		1	—			
78.01		1+	2		78.01	1
75.26		1	1.2			
74.92		1	1		74.92	1
73.69		1.2	—		73.65	1
71.82		1.2	1.2			
71.18		1.2	—			
69.11		1.2	2	V?		
66.33		1.2	2	V? Auch unbedeutende Ti-lin.		
——	**3564**.68					
63.59		1	?			
62.32		1	?			
60.75		1+	1.2			
56.97		2.3	—	ss. Am Rande d. ⊙-lin. 57.03 (Fe).		
56.42		1.2	—			
55.32		1.2	?			
53.43		3	—		53.41	1
45.52		1.2	—	R. 51.67 1	45.42	1
45.34		2	2		45.33	1
43.68		1.2	—		43.63	1

Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.		Vanad λ	R	i V	i ⊙	Bemerkungen.	Rowland.	
——	**3540**.27						3505.83		1+	1.2			
3533.85		3	1		33.82	1	04.57		1.2	1.2			
30.91		2	2				01.65		1			01.61	1
29.90		2—	3	Am Rande d. ⊙-lin.	29.88	1	3498.23		1				
24.89		1.2	?				97.13		1			97.08	1
24.38		2+	1.2	Auch Fe.			93.34		1				
20.18		2	2.3	Schwache Ti-lin.			——	**3491**.46					
——	**3518**.49						89.64		1			89.65	1
17.44		2+	2		17.44	1	86.05		1	2			

Ich bin mir dessen wohl bewusst, dass unter diesen Linien mehrere zu finden sein werden, welche von anderen bisher nicht zu erkennenden Metallen herrühren. Zu dieser Categorie verdächtiger Objecte dürften wahrscheinlich diejenigen Linien des Spectrums gehören, welche bei Vanad unbedeutend im Sonnenspectrum intensiven Absorptionslinien entsprechen. Es scheint dies daraus gefolgert werden zu können, dass im allgemeinen Sonnenspectrum das Vanad nur durch schwache und unbedeutende, den allerstärksten Linien des Metalls entsprechende Linien vertreten ist, während die Linien mittlerer und geringer Intensität des Metallspectrums in der Sonne für gewöhnlich gänzlich fehlen. Vorläufig aber und solange ihr Ursprung nicht hat näher festgestellt werden können, scheint mir das Ausscheiden derselben nicht genug begründet, ebenso wenig wie in solchen Fällen, wo die Linien nur durch äusserste Schwäche den Verdacht eines fremden Ursprungs erwecken.

Wie schon bemerkt ist der wahrscheinliche Fehler der obigen Wellenlängen auf etwa ± 0.02 Å. E. zu veranschlagen. Die Rowlandschen Werthe sind ohne Zweifel genauer und werden wahrscheinlich im Allgemeinen auf zwei Stellen sicher sein. Die Vergleichung unserer Bestimmungen giebt jedoch ein ganz befriedigendes Resultat, indem die auftretenden Differenzen nur in wenigen Fällen den Werth 0.03 Å. E. überschreiten. Unter 431 verglichenen Linien kommen nämlich die folgenden Differenzen in der beigesetzten Anzahl (N) Fällen vor:

Δ = 0.00 Å. E.	N = 80
01	120
02	85
03	75
04	29
05	23
06	7
07	8
08	4

oder es beträgt die Anzahl der Fälle, wo die Abweichungen 0.03 A. E. überschreiten etwa 16 % des Ganzen.

In Rowlands Catalog der Vanadlinien kommen mehrere Linien vor, welche leicht als fremde Verunreinigungen zu erkennen sind. In der folgenden Tafel habe ich dieselben nebst den entsprechenden Wellenlängenwerthen nach Kayser und Runge oder mir zusam-

mengestellt, wobei die Intensitätsschätzungen KAYSERS und RUNGES auf meine Skala übergeführt worden sind:

ROWLAND		KAYSER u. RUNGE		HASSELBERG		Ursprung.
λ	i	λ	i	λ	i	
5535.66	1	35.69	6			Ba.
5424.28	2	24.27	6			Fe.
4715.49	1			15.46	2	Ti.
4501.41	1			01.42	3	Ti.
4456.07	1	56.08	5			Ca.
54.94	1	54.97	6			Ca.
25.59	1	25.61	6			Ca.
4318.80	2	18.80	5			Ca.
4226.87	4	26.91	6			Ca.
4077.85	1	77.88	6			Sr.
57.96	1	57.97	6			Pb.
34.62	2			34.60	10	Mn.
33.19	3			33.18	10	Mn.
3968.59	1	68.63	6	68.62	—	Ca.
61.65	5	61.68	6			Al.
44.13	6	44.16	6			Al.
33.77	3	33.83	6	33.77	—	Ca.
3719.05	1			19.04	2.3	Mn.
06.17	1			06.16	2.3	Mn.
3683.60	1	83.60	6			Pb.
39.72	1	39.71	6			Pb.

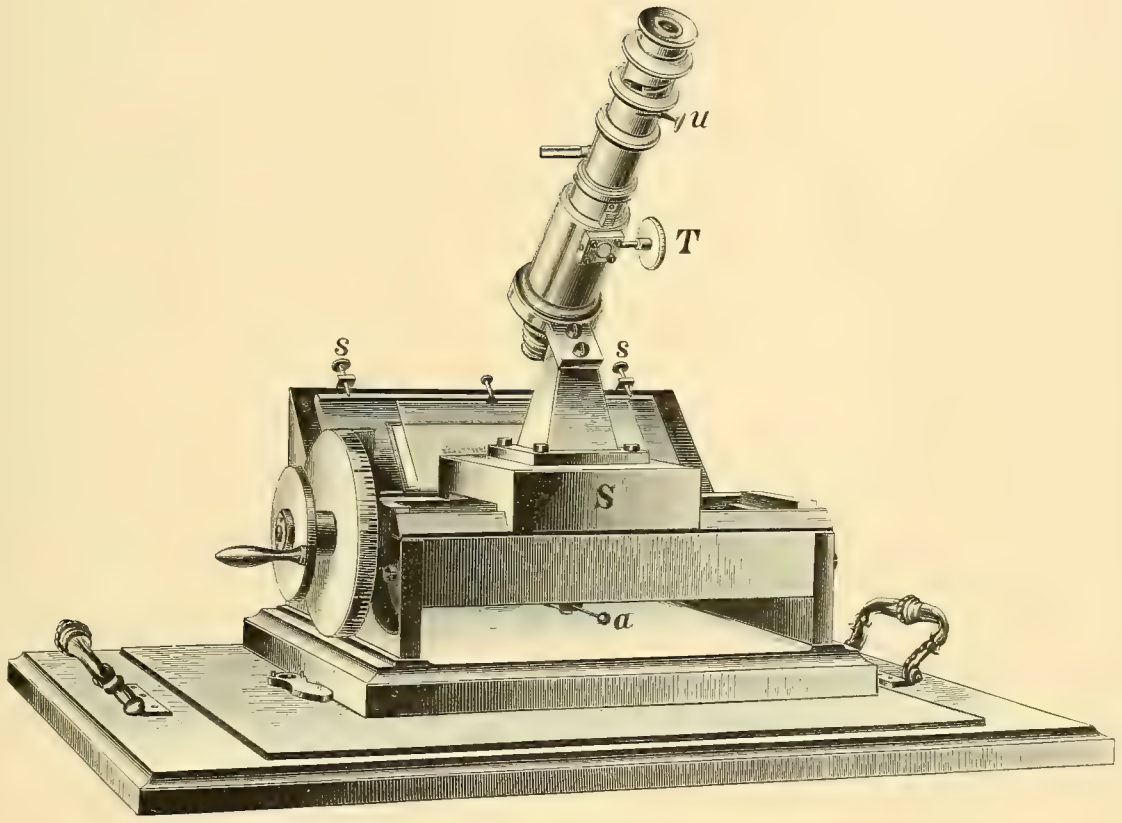
Man findet hier die Hauptlinien vornehmlich des Calciums und des Bleis sowie diejenigen des Aluminiums und unter den bei mir nicht vorkommenden Linien ausserdem wahrscheinlich noch einige Linien der Platinametalle.

Dass Vanad im allgemeinen Sonnenspectrum wenig vertreten ist, indem nur den stärksten Linien des Metalls schwache Absorptionslinien entsprechen, habe ich bereits bemerkt. Um hierüber einen Ueberblick zu gewinnen, habe ich in der folgenden Tabelle alle stärkere Vanadlinien (i = 3 oder darüber) nebst den geschätzten Intensitäten der coincidirenden Linien des Sonnenspectrums zusammengestellt.

Vanad		⊙	Vanad		⊙	Vanad		⊙	Vanad		⊙	Vanad		⊙
λ	i		λ	i		λ	i		λ	i		λ	i	
5737.28	3	—	5671.10	3.4	?	4864.93	4	1.2	4786.70	3	3	4578.92	3	?
31.48	3.4	—	27.86	3.4	1	52.65	4	1.2	76.54	3	1.2	77.36	4	1
27.25	4	1.2	5592.67	3	—	32.59	3	1	70.66	4	—	71.96	3	—
07.26	3.4	1.2	4904.59	3	2	31.80	3.4	1+	4594.27	4.5	2	60.90	3	?
03.83	3.4	1	4881.75	4	1.2	27.62	3.4	1	86.54	4.5	1	49.82	3	2.3
5698.74	4	?	75.66	4	1+	07.70	3.4	1	80.57	4	2	45.60	3.4	?

Vanad		⊙	Vanad		⊙	Vanad		⊙	Vanad		⊙	Vanad		⊙
λ	i		λ	i		λ	i		λ	i		λ	i	
4524.42	3	—	4426.17	3	1	4291.96	3	—	4105.32	3	1.2	3855.50	3	2
02.12	3	—	21.73	3	1	84.19	3	—	02.32	3	1	40.88	3	1
4496.26	3	—	16.63	3	1+	77.13	3	1	4099.93	3.4	2	28.66	3.4	2
89.06	3.4	2	08.67	4.5	3	71.70	3	—	95.64	3	1	18.37	3	2
74.88	3.4	—	08.35	4	2	68.78	3	1	92.83	3	2	13.63	3	?
69.88	3.4	—	07.85	4.5	3	34.12	3	—	90.70	3	1.2	3795.12	3.4	?
62.56	3.4	—	06.80	4.5	2	33.09	3	1.2	57.21	3	—	04.85	3	1.2
60.47	4.5	2.3	00.74	4	1.2	32 62	3	1	3998.87	3	—	03.71	3.4	2
59.93	4	2	4395.40	4.5	2	4134.60	3.4	2.3	34.16	3.4	—	3696.00	3	1
59.65	3.4	3	90.13	4.5	2	32.14	3.4	2.3	10.01	3	2.3	92.37	3	1
52.19	4	1	84.87	4.5	2.3	28.25	3.4	2.3	02.40	3.4	2	83.27	3	—
44.40	3.4	1	79.38	4.5	2.3	23.65	3	2	3893.03	3	—	80.26	3	?
41.88	3.4	1.2	53.02	3.4	1	16.65	3	1.2	90.34	3	1.2	76.86	3	—
38.02	3.4	1	41.15	3	1	15.32	3.4	2	75.22	3	2	73.55	3	1
36.31	3.4	?	32.98	3	1	11.93	4	2.3	65.02	3.4	2	3553.43	3	—
29.95	3	—	30.18	3	1	09.94	3.4	2.3	56.00	4	2	33.85	3	1
28.67	3	1	09.95	3	?									

Es lässt sich nach dieser Tabelle nicht bezweifeln, dass Vanad in der allgemeinen Zusammensetzung der Sonnenatmosphäre eingeht, aber wie es scheint nur in geringer Quantität. In dieser Beziehung sind die Verhältnisse merklich von denjenigen verschieden, welche in den Flecken vorherrschen, in deren Spectra einer Mittheilung von YOUNG zufolge viele im allgemeinen Sonnenspectrum unscheinbare Linien des Vanads eine erhebliche Intensität und Breite erreichen. Das Vorkommen des Vanads in der Sonne hat übrigens in Anbetracht der überaus weiten Verbreitung desselben unter den irdischen Mineralien nichts auffallendes, und es gewinnt auch dadurch die Thatsache sehr an Interesse, dass in der Zusammensetzung einer Menge Meteoriten das Metall ebenfalls eingeht. Bei der Untersuchung der Bogenspectra dieser Körper, welche ich gegenwärtig vorhabe, habe ich häufig Gelegenheit gehabt dies zu beobachten. Ueber diese Frage werde ich nächstens ausführlicher berichten.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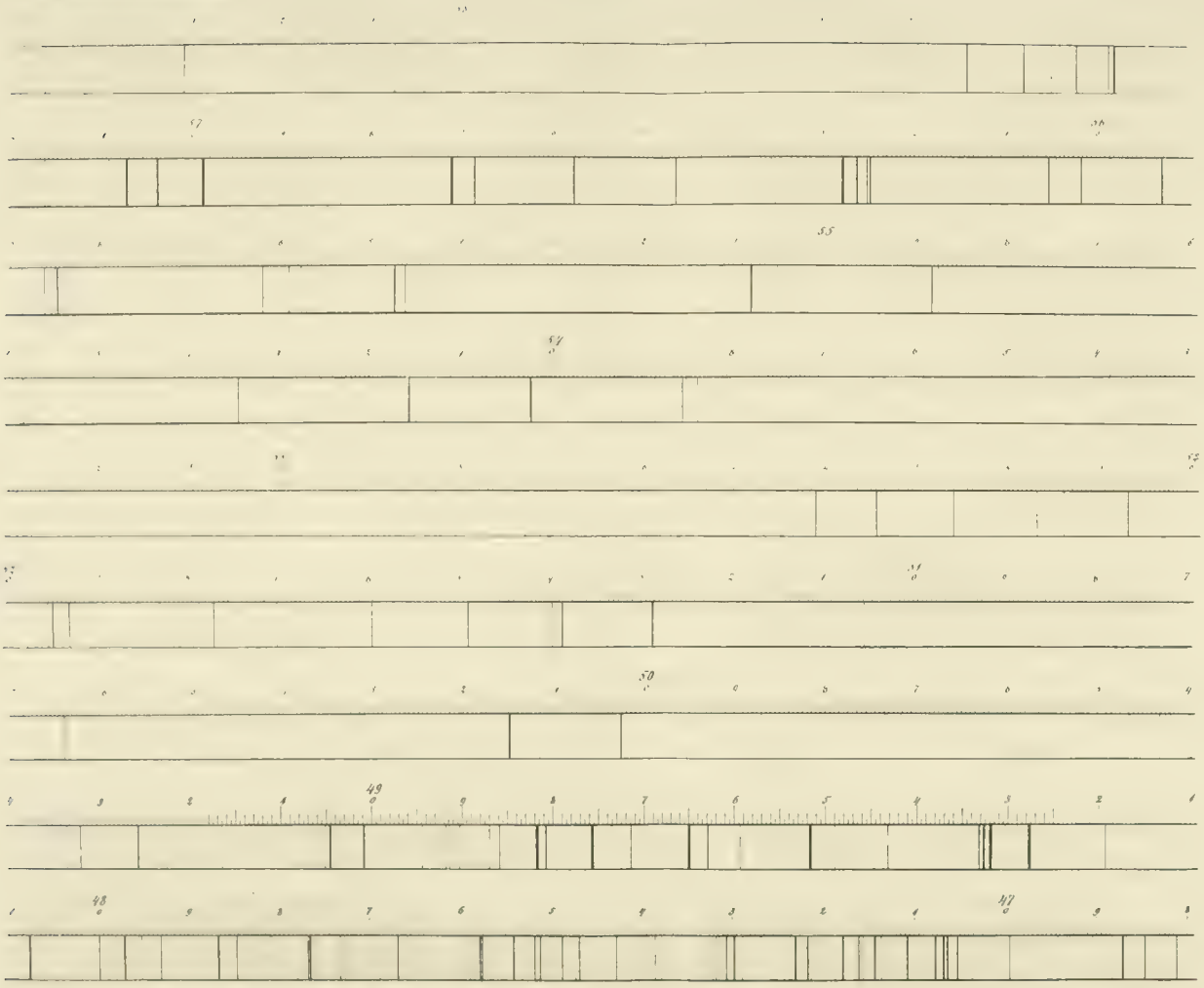

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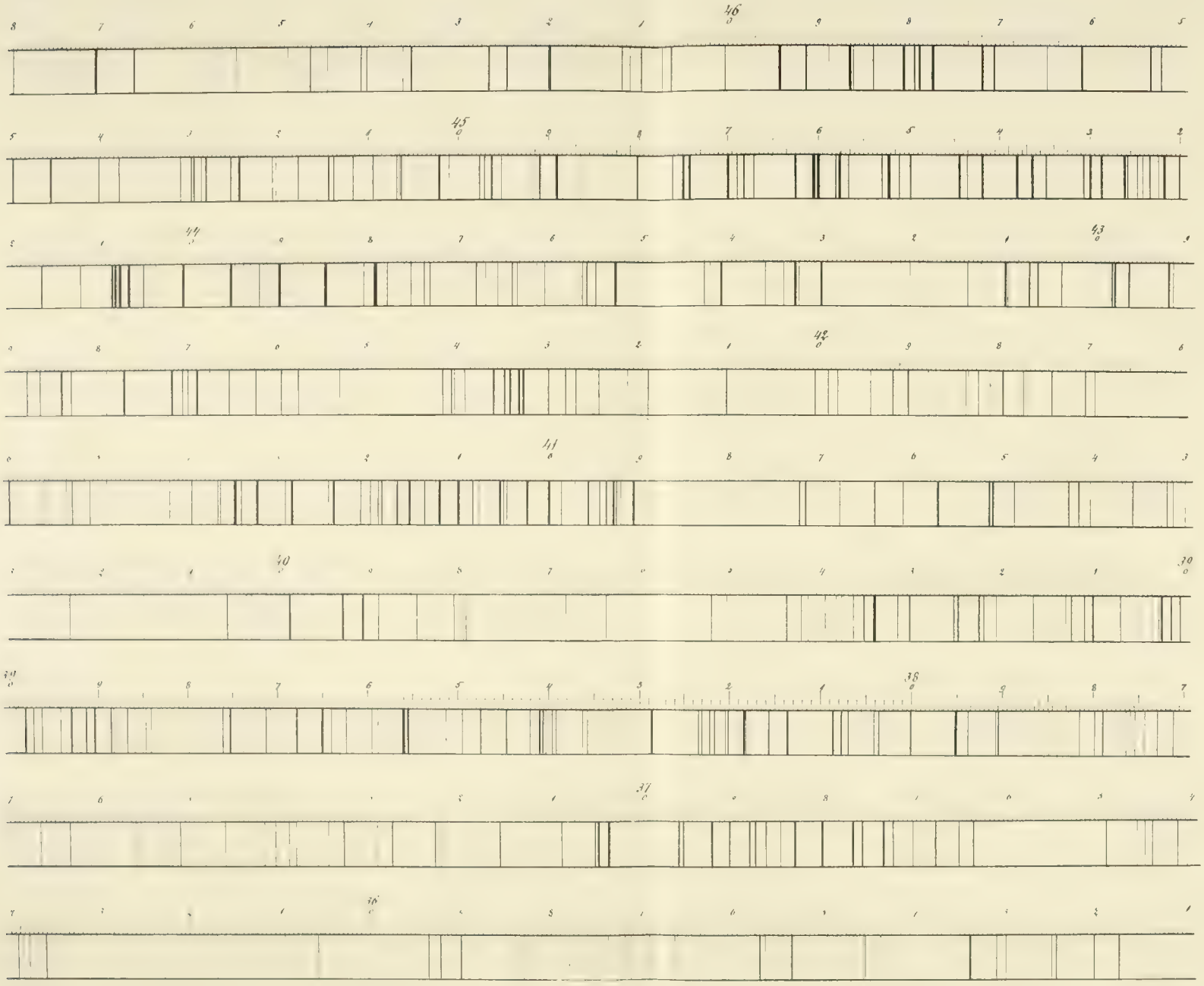
Spectrum des Vanads



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KONGL. SVENSKA VETENSKAPS-AKADEMIENS HANDLINGAR. Bandet 32. N:o 3.

PLANKTON

COLLECTED BY

THE SWEDISH EXPEDITION TO SPITZBERGEN IN 1898

EXAMINED

BY

P. T. CLEVE

WITH 4 PLATES

PRESENTED TO THE R. SWEDISH ACADEMY OF SCIENCES 1899 MARCH 8TH

STOCKHOLM
KUNGL. BOKTRYCKERIET. P. A. NORSTEDT & SÖNER
1899

The scientific Swedish expedition 1898 to Spitzbergen under the direction of Professor A. G. Nathorst paid a particular interest in exploring the plankton of the sea. A great number of samples were gathered, among which about 50 were collected by pumping the water through a silk-net. These gatherings were all small and have been completely examined by me both for animal and vegetable plankton. The other samples, about 100, were brought up by the tow-net, partly from the surface and partly from more or less considerable depths. As Dr. C. Aurivillius has charged himself with the examination of the animals in all the tow-net gatherings, I have examined them for vegetable plankton only, with the exception of the radiolarians, which offered a particular interest for my other plankton-researches.

Plankton-types.

I proposed in 1896[1] to class the plankton of the Atlantic and its tributaries in certain types or formations according to the association of species. For understanding the following it will be necessary first to characterize briefly these plankton-types.

I. **Desmo-plankton** (sign *D*). This formation rules in the warmest part of the Atlantic, in the Sargasso-sea and in the equatorial current.

The *temperature* of the water containing desmo-plankton varies usually between 20° and 28° and the *salinity* is about 36 p. m.

The organisms belong to a great number of species, many of which are identical with those of the Indian Ocean. Among the more characteristic species I can name the following:

Animals.	Plants.
Clausocalanus furcatus,	*Trichodesmium*,
Corycæus longicaudis,	*Pyrocystis pseudonoctiluca*,
C. speciosus,	*Ceratium fusus var. longiseta* (n. v.),
Euchæta marina,	*C. tripos var. flagellifera* (n. v.),
Miracia efferata,	*Ceratocorys horrida*,
Oncæa venusta,	*Goniodoma acuminatum*,
Setella gracilis,	*Ornithocercus magnificus*,
Radiolarians (many species).	*Chætoceros coarctatus*,
	C. tetrastichon,
	Climacodium biconcavum,
	C. Frauenfeldii (= *C. Jacobi* Cl.),
	Hemiaulus Hauckii.

[1] Bih. till K. Sv. Vet.-Akad. Handl. XXII, 3, N:o 5. — A treatise on the phyto-plankton. Upsala 1897.

II. **Styliplankton** (Sign *S*). The region of desmoplankton, which is subject to variation in extent according to the seasons, is surrounded by an irregular band of water containing styliplankton. In the west this plankton-type seems always to occur in mixture with desmoplankton, and such a mixture characterizes the Caribbean Sea, the Antilles-current to the region of Bermuda. About the 40° breadth the styliplankton becomes more differentiated and the region increases in breadth towards the European and African coasts. It forms a narrow band west of Africa from Cape Verde to Canaries and occupies the triangular space between the Azores, the English Channel and Bermuda. The extent of the region is subject to great variation according to the seasons. In the summer it approaches towards the Färöe Channel (probably also towards Iceland) in a mighty tongue, which sends branches through the English Channel into the German Ocean and around Scotland into the North Sea. When the water enters the North Sea its salinity becomes lowered by admixture of the continental coast-water and, consequently, the plankton becomes also modified. Some of the species die away, others multiply, and thus are originated in the North Sea two important *derived styli-planktontypes, the tripos-plankton in the north and the didymus-plankton in the south.* I have distinguished as a third type of North Sea plankton the *halosphæra-plankton.* This kind also originates from the styliplankton by an considerable increase of the green alga Halosphæra viridis, which seems to take place in the autumn around Färöe, from whence it descends to Scotland and enters the North Sea finally reaching Skagerack.

The styliplankton-water, which in the beginning of the summer reaches the Färöe Channel proceeds during the autumn towards Spitzbergen.

The *temperature* of this water varies usually between 10° and 20° and the *salinity* is about 35 p. m.

The number of *organisms* constituting the styliplankton is very considerable and the flora and fauna are subject to a great variability according to the breadth and the season. Some species appear simultaneously at the African and South American coasts, others occur in the whole region, others again seem to be limited to the eastern part. I name among the more common and characteristic forms the following, marking with *e* such forms, as occur in the eastern Atlantic. With *s* I denote forms, which as a rule do not pass over the Färöe Channel, and with *n* forms which enter the northern Atlantic.

Animals.	**Plants.**
Acartia Clausii (*e n*),	*Halosphæra viridis* (*n*),
Centropages typicus (*n*),	*Ceratium* (*trip. v.*) *auritum* (*e s*),
Clausocalanus arcuicornis (*s*),	*C. candelabrum* (*s*),
Corycæus rostratus (*e s*),	*C. furca* (*e n*),
Mecynocera Clausi (in the spring *s*),	*C. lineatum* (*n*),
Microsetella atlantica (*n*),	*C. reticulatum* (*s*),
Oithona plumifera (*s*, *n* rarely),	*Dinophysis homunculus* (*s*),
O. similis (*n*),	*Diplopsalis lenticula* (*n*),
Oncæa minuta (*e n*),	*Gonyaulax polygramma* (*n*),
Paracalanus parvus (*n*),	*Peridinium divergens* (*n*),

Temora stylifera (*s*),
Sagitta bipunctata (*n*),
Globigerina bulloides (*n*),
Codonella lagenula (*s*),
Cyttarocylis acuminata (*s*),
C. cassis (*s*),
C. ganymedes (*s*),
C. Treforti (*s*),
Dictyocysta elegans (*e n*),
D. mitra (*s*),
Tintinnus Fraknoi (*s*).

Peridinium oblongum[1] (*n*),
Chætoceros furca (*s*),
C. Lorenziana (*s*),
C. volans (*n*),
Corethron hystrix (*e n*),
Coscinodiscus sol (*e*),
Dactyliosolen antarcticus (*e n*),
Hemidiscus cuneiformis,
Rhizosolenia alata (*n*),
R. gracillima (*n*),
R. styliformis (*n*).

The derived stylitypes of the North Sea, the *didymus-* and *tripos-plankton*, are characterized as follows.

A. **Didymus-plankton** (Sign *Nm*). This plankton-type rules in the summer and autumn along the southern coasts of the German Ocean above the 50 metre-plateau of the bottom.

The *temperature* varies between 8° and 17° and the salinity is about 32 or 33 p. m.

The organisms are numerous and the diatoms constitute an important part of them. Among the animals many are common to didymus- and triposplankton and their names are in the following lists enclosed in parenthesis. As the more common species we note:

Animals.
(*Acartia Clausii*),
(*Centropages hamatus*),
(*C. typicus*),
Corycæus anglicus,
Isias clavipes,
Labidocera Wollastonii,
(*Oithona similis*),
(*Paracalanus parvus*),
Podon polyphemoides,
(*Sagitta bipunctata*),
Oikopleura dioica,
Noctiluca miliaris,
Tintinnopsis campanula.

Plants.
Bacteriastrum varians,
Biddulphia mobilensis,
Cerataulina Bergonii,
Chætoceros curvisetus,
C. danicus,
C. didymus,
C. Schüttii,
C. Weissflogii,
Ditylum Brightwellii,
Eucampia zodiacus,
Guinardia flaccida,
Rhizosolenia Shrubsolii,
R. Stolterfothii,
Streptotheca tamesis.

B. **Triposplankton** (Sign *Tp*) rules in the summer and autumn in the northern part of the North Sea above the 100 metre-plateau of the bottom and extends from Scotland to Scandinavia as far as Finmarken. In the spring it is replaced by water with chæto-plankton.

[1] *Perid. divergens v. oblonga* AURIV.

The *temperature* varies usually between about 5° in the winter and 14° in the summer, and the salinity is about 34 p. m., but these figures are subject to great variations according to relative abundance of oceanic or coast-water that enters in the composition of the triposplankton-water.

The triposplankton is chiefly constituted by cilioflagellates and entomostraca, the diatoms being almost absent. As stated above the animals are to a great extent of the same species as in the didymusplankton, which is easily explained as both types are derived from styliplankton.

Among the organisms we note the following:

Animals.	Plants.
(*Sagitta bipunctata*),	*Ceratium furca*,
(*Acartia Clausii*),	*C. fusus*,
Anomalocera Patersonii,	*C. tripos*,
Calanus finmarchicus,	*C. trip. v. macroceros*,
(*Centropages typicus*),	*Peridinium divergens*.
(*Oithona similis*),	
(*Paracalanus parvus*),	
Pseudocalanus elongatus,	
Temora longicornis,	
Evadne Nordmannii,	
E. spinifera,	
Podon intermedius.	

Many of the species of the styliplankton also enter into the triposplankton, as *Acanthometron quadrifolium*. *Plectophora arachnoides*, probably originally belonging to the chætoplankton and abundant around Scotland, enters also frequently into the triposplankton.

III. **Chætoplankton** (Sign *C*). This planktontype occurs in the western and northern parts of the Atlantic only and during the spring. From March to June or July it can be traced from about the 40° Lat. and 70° Long. to the Newfoundland Banks and to the south of Iceland, from whence it turns across the Färöe Channel and enters the North Sea, replacing its triposplankton, and reaches the coasts of Scandinavia. It disappears in the summer, becoming replaced by styliplankton, but rules in July and August around Spitzbergen. When the water with the chætoplankton touches the coasts, especially of Iceland, it sweeps away the neritic plankton there and spreads it along the coasts of Scotland and Scandinavia, where it enters into the fjords. Thus many species of northern origin may remain during the summer emprisoned in the fjords, especially in their deeper water.

The *temperature* of the chætoplankton-water varies usually between 5° and 9° and the *salinity* is about 35 p. m.

The organisms of the chætoplankton are chiefly diatoms, especially *Chætoceros decipiens* and *Ch. constrictus*. *C. borealis* and *C. criophilus* occur both in chæto- and trichoplankton so that it is difficult to decide whether they belong to one or the other type.

Another organism, the flagellate *Phæocystis Pouchetii*, appears in the same time as Chætoceros decipiens, frequently in great abundance, and has about the same distribution. I therefore include also that organism among the chæto-species.

IV. **Trichoplankton** (Sign *T*). This type rules in the western Atlantic and constitutes in the summer the plankton of the Irminger Sea. Its origin is doubtful. Typical trichoplankton was gathered in the Bering Sea during the expedition of the Vega and it is an open question whether it spreads from the northern Pacific to the northern Atlantic or vice versa. In the winter (1897—98) the characteristic species of the trichoplankton appeared as far down to the south as to the south of the Azores, which possibly may be owing to the plankton of the Labrador-current having been conveyed by the south-going branch of the Gulf-stream. In the summer it is confined to the western and arctic Atlantic, but in the winter it spreads to Scandinavia.

The *temperature* of the trichoplankton-water varies between 6° and 12° and the salinity amounts to about 34 p. m.

As the trichoplankton frequently becomes mixed with chætoplankton and with siraplankton it is a difficult matter to make out to what type a number of species really belong. I consider the following as chiefly tricho-organisms:

Animals.	**Plants.**
Calanus finmarchicus,	*Ceratium tripos v. arctica*,
Fritillaria borealis,	*Chætoceros atlanticus*,
Spadella hamata,	*Coscinodiscus oculus iridis*,
Cyttarocylis denticulata (with the varieties *edentula*, *media* and *gigantea*),	*Rhizosolenia obtusa*,
	R. semispina,
	Thalassiosira gravida,
Ptychocylis acuta,	*Thalassiothrix longissima*.
Tintinnus minutus.	

On the coasts, washed by the trichoplankton-water, there originates a peculiar kind of derived trichoplankton, which I have designated as

Northern neritic plankton (Sign *Ns*). This somewhat variable type occurs at the coast of Iceland, in Skagerack and in the fjords of Sweden during the winter, also in the fjords of Norway and on the Norwegian coast-banks, where it becomes in the summer slowly replaced by triposplankton. This kind of plankton seems to invade the coasts of Scotland and Scandinavia twice a year, viz. in the spring in company or in connection with the chætoplankton and in the autumn in connection with the trichoplankton. The detailed study of this kind of plankton will doubtless afford very interesting results as different species rule on different coasts. Thus for instance the *Asterionella spathulifera* abounds in the south coast of Iceland and becomes from thence transported to Scotland and as far southwards as to the coast of Holland. On the coast-banks of Norway *Ceratium tripos v. longipes* is the ruling species. The Limfjord of Denmark affords particular advantages for the development of some species, as *Skeletonema costatum* and *Chætoceros debilis*,[1] which remain there for the greater part of the year.

[1] C. G. T. PETERSEN. Beretning fra den danske biologiske Station 1898.

The *temperature* of the water with northern neritic plankton varies in Skagerak from about 4° to 7° and the *salinity* is about 32—33 p. m.

As species constituting the northern neritic plankton we name the following:

Animals.	Plants.
(*Acartia longiremis*),	*Asterionella spathulifera*,
(*Calanus finmarchicus*),	*Biddulphia aurita*,
(*Centropages hamatus*),	*Chætoceros debilis*,
(*Pseudocalanus elongatus*),	*C. diadema*,
(*Temora longicornis*),	*C. scolopendra*,
Tintinnopsis beroidea,	*C. teres*,
T. ventricosa.	*Coscinodiscus polychordus*,
	Leptocylindrus danicus,
	Skeletonema costatum,
	Thalassiosira gelatinosa,
	Thalassiothrix Frauenfeldii,
	Ceratium tripos v. longipes,
	Gonyaulax spinifera,
	Peridinium depressum.

V. **Sira-plankton** (Sign *Si*) rules along the coasts of Greenland and in Baffins Bay, or in the Arctic Ocean properly, where it constitutes the plankton of the water with melting drift-ice. As it touches the trichoplankton it becomes frequently mixed with it, so that the distinction of what species belong to one or the other is a matter of difficulty. The water with sira-plankton has lower temperature than the trichoplankton-water and less salinity, about 32—33. This type might be considered as a kind of neritic plankton, did not the most characteristic species, *Thalassiosira Nordenskiöldii*, at certain periods occur in wide areas north of the Kara Sea and between Spitzbergen and Finmarken. Typical sira-plankton is almost free from animals and contains as its most characteristic species *Thalassiosira Nordenskiöldii*, *Fragilaria oceanica*, *Lauderia fragilis*, *Chætoceros furcellatus* and *C. socialis*. It is frequently mixed with some northern neritic forms as *Chætoceros debilis*, *C. diadema*, *C. scolopendra*, *Coscinodiscus oculus iridis*, *Biddulphia aurita*, *Thalassiosira gravida* etc.

This kind of plankton appears in Skagerak usually in February and March.

Along the coast of Greenland the sira-plankton becomes mixed with a number of neritic forms and such a derived sira-plankton I have distinguished as

Arctic neritic plankton (sign *Ng*). This kind of plankton contains, besides the species of sira-plankton, the following:

Amphiprora hyperborea,	*Eucampia groenlandica*,
Achnanthes tæniata,	*Fragilaria cylindrus*,
Chætoceros septentrionalis,	*Navicula septentrionalis*,
Coscinodiscus bioculatus,	*Nitzschia frigida*,
C. hyalinus,	*Pleurosigma Stuxbergii*.

Surface-plankton.

In the following account of the plankton, gathered by the Swedish expedition to Spitzbergen in 1898, I distinguish, as usually, with *c* common, *cc* very common, *ccc* the principal mass, with + neither common nor rare, with *r* rare, and *rr* some few specimens only. In case of scarcity of the plankton I enclose the sign by one or two parentheses and where no plankton was found I use 0.

1. Lindesnäs—Lofoten.

May 27th to June 1th.

Temperature varying between 7° and 9°. Salinity 33—35 p. m.

The plankton is of great uniformity, being a mixture of tripos- and northern neritic plankton (*Tp*, *Ns*).

The most important species are the following:

Of triposplankton:

Acartia Clausii +,
Microsetella atlantica r,
Oithona similis +,
Evadne Nordmannii c,
E. spinifera c,
Podon intermedius r,
Halosphæra viridis r,
Ceratium furca +,
C. fusus +,
C. tripos r,
C. trip. v. macroceros c,
Rhizosolenia styliformis rr.

Of northern neritic plankton:

Acartia longiremis c,
Ceratium tripos var. longipes cc,
Peridinium depressum +,
Coscinodiscus oculus iridis rr.

Common to both:

Calanus finmarchicus +,
Temora longicornis +.

One sample only (63° 13′ N 5° 15′ E.) contained *Leptocylindrus danicus* in abundance.

The plankton of this region agrees completely with that of June 1896.[1] If compared with the plankton of May 1897 in the same region, we mark that the triposplankton occurred in 1898 in greater abundance. This corresponds with the lower temperature (5,45—9,72) and salinity (28,05 to 34,11) in the year 1897.

[1] Bih. till K. Sv. Vet.-Akad. Handl. XXIII, 2, N:o 4.

2. Lofoten—Beeren Eiland.

June 2d to June 12th.

Temperature 7,55 to 5,15; near Beeren Eiland 2,40. Salinity 34—35.

The ruling plankton is chætoplankton, mixed with variable amounts of tricho- and styliplankton.

In the chætoplankton:	In the trichoplankton:	In the styliplankton:
Plectophora arachnoides r,	*Calanus finmarchicus c,*	*Oithona plumifera rr,*
Chætoceros criophilus c,	*Chætoceros criophilus c,*	*Collozoum inerme* +,
C. decipiens c,	*Coscinodiscus oculus iridis r,*	*Chætoceros volans* +.
Phæocystis Pouchetii (*c* near Beeren Eiland).	*Rhizosolenia semispina* +, *Thalassiothrix longissima r.*	

Interesting is the occurrence of the styliplanktonforms, of which *Oithona plumifera* and *Collozoum* indicate a far distant origin (probably the region of the Azores). *Plectophora arachnoides* indicates that the water has passed the Färöe Channel.

In June 1896 and May 1897 this region was almost sterile, containing traces only of northern neritic plankton.

3. Beeren Eiland—Hope Island.

June 20th to June 23d.

Temperature —0,35 to +0,97 and salinity 34,76 to 32,97.

The ruling plankton is chætoplankton with *Chætoceros decipiens* and *Phæocystis Pouchetii;* tricho-plankton is also represented by *Calanus finmarchicus, Cyttarocylis gigantea* and *Coscinodiscus oculus iridis,* and arctic neritic plankton by the rare occurrence of *Ptychocylis obtusa.*

4. Hope Island—Icefjord.

June 24th.

Temperature 0,6 to 3,0. Salinity 33,80 to 35,06.

An almost sterile region with some few specimens of *Phæocystis Pouchetii* (*C*) and *Thalassiosira Nordenskiöldii, Chætoceros furcellatus, Ptychocylis obtusa* and *Peridinium pellucidum* (*Ng*).

5. Icefjord—Swedish Depth—Süd Cape.

July 26th to August 2d.

The plankton is subject to great variation, occurs as a rule sparingly and belongs to chæto-, styli- and tricho-plankton. In August 1896 chæto-plankton chiefly ruled in this region.

Month	VII	VII	VII	VII	VIII
Day	26	26	30	31	1
Lat.	78° 13′	77° 53′	78° 12′	77° 14′	76° 36′
Long.	7° 30′ E.	5° 3′ E.	0° 17′ W.	6° 34′ E.	12° 8′ E.
Temp.	5,34	4,78	4,59	5,35	7,38
Sal.	34,89	34,57	34,53	34,77	35,12
Pl.-type	(*Ng S*)	(*T C*)	(*T C*)	*T S*	*T S*
Calanus finmarchicus	.	.	.	*r*	.
Oithona similis	*r*	.	+	.	+
Euthemisto libellula	*r*	.	.	.	.
Cyttarocylis edentulata	.	*r*	*c*	*cc*	.
C. media	*r*	*r*	+	.	.
Ptychocylis obtusa	*r*	.	.	.	.
Litholophus ligurinus	*r*	.	.	.	.
Ceratium (trip. v.) arcticum	*r*	*r*	*r*	.	+
C. (trip. v.) longipes	.	.	.	.	*r*
Peridinium pellucidum	*r*	+	*c*	.	.
Chætoceros borealis	.	*r*	.	.	*r*
C. decipiens	.	+	*c*	.	.
C. volans	.	.	.	*c*	+
Rhizosolenia gracillima	.	.	.	*c*	.
R. obtusa	.	*r*	.	.	.
R. semispina	.	.	.	.	*c*

6. Süd Cape—King Charles Land.

August 3d to August 6th.

Much drift-ice. Temperature 1 to 3,94. Salinity 30,98 to 34,45.

The plankton consists chiefly of *chætoplankton*, mixed with *trichoplankton* and a little arctic neritic plankton. *Oithona similis* was also found.

The more important species were the following:

Chætopl.:

Chætoceros decipiens +,
Phæocystis Pouchetii r.

Trichopl.:

Calanus finmarchicus r,
Cyttarocylis denticulata r,
var. obtusa r,
var. gigantea c,
var. media r,
Tintinnus minutus r,
Ceratium (trip v.) arcticum c,
Coscinodiscus oculus iridis +,
Rhizosolenia semispina r.

Arctic neritic pl.:

Peridinium pellucidum +,
Ptychocylis obtusa +.

7. King Charles Land. Round Spitzbergen. North west of Spitzbergen.

August 13th. August 25th.

Temperature —0,58 to +3,44. Salinity about 33 p. m.
The plankton is constituted by chæto-, tricho- and arctic neritic plankton.
The following were the most important:

Chætopl.	Trichopl.	Arctic neritic plankton.
Chætoceros borealis +,	*Calanus finmarchicus r*,	*Cyttarocylis dentic. v. obtusa c*,
C. criophilus r,	*Fritillaria borealis r*,	*Fungella arctica r*,
C. decipiens +,	*Cyttarocylis denticulata r*,	*Ptychocylis obtusa c*,
Phæocystis Pouchetii r.	*v. gigantea c*,	*Dinobryum c*,
	v. media r,	*Peridinium pellucidum* +.
	Tintinnus borealis r,	
	Ceratium arcticum c,	
	Chætoceros atlanticus r,	
	C. boreal. v. Brightwellii r,	
	C. criophilus r,	
	Coscinodiscus oculus iridis rr,	
	Rhizosolenia obtusa r,	
	Thalassiosira gravida r.	

Besides these species were found *Oithona similis*, common in some gatherings, and the following of the northern neritic plankton: *Ceratium* (*tripos v.*) *longipes r*, *Chætoceros diadema r*, *Leptocylindrus danicus r.*

8. West of Spitzbergen—Beeren Eiland.

August 28th to September 4th.

Temperature 5,34 to 7,24. Salinity about 35.

The plankton is composed of styliplankton, usually predominant, and trichoplankton. The most important forms are:

Styliplankton.	Trichoplankton.
Microsetella atlantica r,	*Calanus finmarchicus*,
Oithona similis c,	*Fritillaria borealis*,
Oncæa minuta +,	*Cyttarocylis denticulata r*,
Globigerina bulloides r,	*var. media c*,
Challengeria tridens r,	*var. edentula* +,
Litholophus ligurinus r,	*var. gigantea r*,
Chætoceros borealis v. solitaria +,	*Ptychocylis acuta r*,
C. volans cc,	*Tintinnus secatus r*,
Corethron hystrix r,	*T. minutus r*,
Rhizosolenia alata r,	*Ceratium tripos v. arctica r*,

R. gracillima (in some spots),
R. hebetata +,
R. styliformis r to *c*.

Chætoceros atlanticus r,
C. criophilus +,
Rhizosolenia obtusa r to *c*,
Thalassiosira gravida r,
Thalassiothrix longissima rr.

Among these species some are of a particular interest, for instance *Challengeria tridens* and *Plectophora arachnoides*, radiolarians known from the Färöe Channel. *Litholophus ligurinus* and the still more interesting *Oncœa minuta* can be traced from the Mediterranean and the Azores to the mouth of the English Channel and Färöe Channel, thus indicating the course the styliplankton-water has taken.

In the year 1896 in August this region west of Spitzbergen was sterile, and north of Beeren Eiland there ruled typical trichoplankton. I July 1897 chætoplankton was preponderant west of Spitzbergen and was north of Beeren Eiland mixed with trichoplankton. Styliplankton appeared very sparingly at first south of Beeren Eiland.

9. Beeren Eiland—Fuglö.

September 4th to September 6th.

Temperature 8,8 to 9,40. Salinity about 35.

The plankton is constituted, as north of Beeren Eiland, of *styli-* and *trichoplankton*, but with an admixture of triposplankton and northern (Norwegian) neritic plankton.

Styli- and tripos-plankton.

Acartia Clausii r to +,
Microsetella atlantica r,
Oithona similis + to *cc*,
Oncœa minuta r,
Acanthometron quadrifolium c,
Acanthonia Mülleri r,
(*Plectophora arachnoides r*),
Globigerina bulloides r,
Halosphæra viridis c,
Ceratium furca r to *c*,
C. fusus r to +,
C. tripos +,
C. trip. v. macroceros cc,
Peridinium divergens +,
Corethron hystrix r,
Rhizosolenia alata r,
R. gracillima r to +,
R. hebetata r.

Tricho- and northern neritic plankton.

Calanus finmarchicus c,
Cyttarocylis denticulata r,
v. gigantea c,
v. media r,
Ptychocylis acuta r,
Ceratium tripos v. longipes c,
Peridinium depressum r.

It follows from the above analysis of the plankton-gatherings that in the year 1898 the styliplankton was by far more richly represented than in the two precedent years.

Deep-sea Plankton.

At some stations plankton was gathered by hauls from different depths. As Dr. Aurivillius will describe the animals found in these samples, I have examined the vegetable plankton and the radiolarians only, and being thus unable to give a complete account of these gatherings I confine myself here to shortly characterizing them so far as regards the phytoplankton and the radiolarians.

1. **Station M.** 26 to 27 July. Lat. 77° 39′. Long. 1° 18′ E. 100—0 metres. Salinity at 100 m. 34,97, in the surface 32,22. Temp. 5,07.

This sample contained trichoplankton (*Chætoceros criophilus*, *Rhizosolenia obtusa*) and some arctic neritic plankton (*Dinobryum*), but the animals indicate the presence of an amount of styliplankton of the same kind as in the surface west and south of Spitzbergen in August and September.

2. **Station N.** 28 July. Lat. 77° 52′ N. Long. 3° 5′ W.

a. Haul 10—0 m. Temp. at 0 m. 3,63. Salinity 34,38. Chiefly chætoplankton (*Chætoceros decipiens*, *Phæocystis Pouchetii*) and arctic neritic plankton (*Dinobryum*).

b. Haul 25—0 m. Temp. at 25 m. 2,72. Salinity 34,74. The same kind of plankton.

c. Haul 100—0 m. Sal. at 100 m. 35,03. Plankton sparingly (*Phæocystis Pouchetii*).

d. Haul 500—0 m. Temp. at 100 m. +0,83. Sal. 35,03. Content the same as *a*, but, in addition, *Rhizosolenia gracillima* and some animals of the styliplankton-type.

The conclusion is, that the deeper strata contained styliplankton, the upper chætoplankton.

3. **Station O.** 29 to 30 July. Lat. 78° 13′ N. Long. 2° 58′ W.

a. Haul 100—0 m. Temp. at 0 m. 3,1, sal. 33,76; at 100 m. 1,17, sal. 35,03. Content: chiefly *Phæocystis Pouchetii*, thus chætoplankton.

b. Haul 500—0 m. Temp. at 500 m. 0,95, sal. 35,03. Content as *a*, and besides, rarely *Challengeria tridens* and some other styliplankton forms.

c. Haul 2,600—0 m. Temp. at 2,700 m. —1,48, sal. 34,96. Chiefly as *a* but with radiolarians of many species sparingly. Among the radiolarians were found a number of new forms which will be described further on. Among known forms *Aulacantha lævissima*, *Challengeria tridens* and *Trochodiscus echinidiscus* are known from the Färöe Channel, *Stichopilium Davisianum* from the bottom mud near Greenland, also *Artrostrobus annulatus*, which latter was first found near Kamtchatka. *Dictyophimus gracilipes* is known from Kamtchatka only. *Challengeria Harstoni* was dredged by the Challenger-expedition from the abysmal depths east of Japan. Among the new forms is *Polypetta holostoma*, allied to *P. tabulata* from the central Indian Ocean. *Aulodendron antarcticum*, *Auloscena spectabilis* and *Sagenoscena penicillata* are known from the Antarctic Ocean only.

4. **Station P.** August 1th. Lat. 76° 36′ N. Long. 12° 13′ E.

a. Haul 25—0 m. Temp. at 0 m. 7,1, at 25 m. 5,8. Sal. at 0 m. and at 25 m. 35,12. Styliplankton and trichoplankton as west of Spitzbergen.

b. Haul 50—0 m. Temp. at 50 m. 4,98. Sal. 35,13. Similar to *a*.

c. Haul 100—0 m. Temp. at 100 m. 3,75. Sal. 35,05. Similar to *a*.

d. Haul 500—0 m. Temp. at 500 m. 2,5. Sal. 35,10. As *a*, but contained some radiolarians, as *Artrotrobus annulatus, Dictyophimus gracilipes, Acanthocorys umbellifera.*

5. **Station S.** Aug. 20th. Lat. 81° 14′. Long. 22° 50′ E.

a. Haul 10—0 m. Temp. at 0 m. 0,38, sal. 32,49. Temp. at 10 m. 1,18, sal. 33,42. Plankton chiefly trichoplankton (most common: *Chætoceros borealis, C. bor. v. Brightwelli, C. criophilus, Rhizosolenia obtusa* and *Thalassiosira gravida*) and sparingly arctic neritic plankton (*Chætoceros diadema, Leptocylindrus danicus*).

b. Haul 25—0 m. Temp. at 30 m. 3,3. Sal. 34,41. The same as *a*.

c. Haul 130—0 m. Temp. at 100 m. 1,7, at 150 m. 1,98. Sal. at 100 m. 34,77, at 150 m. 34,83. Plankton as in *a*, but some animals indicate the presence of styliplankton.

6. **Station T.** August 27th. Lat. 79° 58′ N. Long. 9° 35′ E.

a. Haul 10—0 m. Temp. at 0 m. 4,58. S. 34,53. This gathering contained the following:

Chætoplankton.	Trichoplankton with northern and arctic neritic plankton.	Styliplankton.
Chætoceros borealis r,	*Chætoceros atlanticus r,*	*Rhizosolenia gracillima +,*
C. criophilus c,	*C. borealis r,*	*R. hebetata r,*
C. decipiens r,	*var. Brightwellii +,*	*R. styliformis r.*
Phæocystis Pouchetii +.	*C. criophilus c,*	
	C. diadema c,	
	C. teres r,	
	Leptocylindrus danicus r,	
	Thalassiosira gravida c,	
	Dinobryum r.	

The plankton is thus constituted principally of trichoplankton with some arctic or northern neritic plankton and contains a small amount of chæto- and styliplankton.

b. Haul 100—0 m. Temp. at 100 m. 3,7. Sal. 35,12. Plankton similar to *a*, but contained besides *Globigerina, Challengeria tridens, Plectophora arachnoides,* which indicate an increased amount of styliplankton.

c. Haul 400—0 m. Temp. at 430 m. 1,5. Sal. 35,06.

Similar to *b* but with some additional styliplankton-forms as *Diplopsalis lenticula* (*rr*), *Chæt. borealis var. solitaria* (*r*), *Chætos. volans* (*r*), *Oithona plumifera, Oncæa minuta,* indicating an increased amount of styliplankton. This sample was examined for radiolarians, of which several new forms were found. Among known species were found *Challengeria Harstoni* and *Dictyophimus gracilipes* as in the deep-sea haul at the station O

and besides *Acanthocorys umbellifera* (stylipl.) and *Theocalyptra cornuta*, the last named being known from Kamtchatka and Greenland and found by me this year (7. III) in the surface at 63° 1′ N. and 1° 36′ E.

The conclusion is that the water below 100 m. contains styliplankton and is covered with a sheet of trichoplankton-water.

7. **Station U.** September 1th. Lat. 75° 50′. Long. 15° 25′ E.

a. Haul 2—0 m. Temp. at 0 m. 5,73. Sal. 34,91. The plankton contained:

Chætoplankton.	Tricho- and northern neritic plankton.	Styliplankton.
Chætoceros criophilus cc,	*Chætoceros criophilus cc,*	*Rhizosolenia styliformis r.*
C. decipiens rr.	*C. diadema c,*	
	C. laciniosus r.	

Chiefly trichopl. with traces only of styli- and chætopl.

b. Haul 100—0 m. Similar to *a*.

c. Haul 320—0 m. Temp. at 350 m. 2,73. Sal. 35,13. Similar to *a*, but also with animals of the stylitype (*Oithona plumifera, Oncæa minuta, Challengeria tridens* etc.). This sample was examined for radiolarians, of which were found *Challengeria Harstoni, Acanthocorys umbellifera, Theocalyptra cornuta, Dictyophimus gracilipes* etc. indicating the same kind of water as in the deeper strata at St. O, T etc.

8. **Station X.** September 5th. Lat. 71° 50′. Long. 19° 2′ E.

a. Haul 25—0 m. Temp. at 0 m. 9,08. Sal. 34,96.

Northern neritic plankton.	Styli- and triposplankton.
Ceratium tripos v. longipes c,	*Halosphæra viridis* +,
Dinophysis acuta r,	*Ceratium furca* +,
Gonyaulax spinifera r,	*C. fusus r,*
Peridinium depressum r,	*C. lineatum rr,*
P. ovatum r,	*C. tripos* +,
P. pellucidum r,	*C. trip. v. macroceros c,*
Chætoceros borealis v. Brightwellii r,	*Rhizosolenia alata r,*
C. contortus r.	*R. gracillima cc,*
	R. hebetata rr,
	R. styliformis rr.

The plankton contained, besides, *Globigerina, Acanthometron quadrifolium* and other species of the stylitype. The constituent plankton was thus styliplankton mixed with some northern neritic plankton.

b. Haul 230—0 m. Temp. at 200 m. 5,5. Sal. 35,13.

The plankton was nearly the same as in *a* and was examined for radiolarians. Among known forms were noted *Challengeria tridens, Acanthocorys umbellifera, Lithomitra lineata* and *Cromyomma zonaster*, the last named known from Greenland (2,000 m.).

The general result of this examination of the deep-sea gatherings might be summarized as follows:

The deeper strata with the sal. 35 contain chiefly styliplankton (from the eastern temperate Atlantic and Färöe Channel). This water reaches the surface at St. X.

The upper strata with 32—34 sal. contain at the stations N and O *chætoplankton*, at the stations M, P, S, T, U *trichoplankton*. As the latter type has been found this spring ruling in the region east of Greenland and north of Iceland it may derive from that part of the Ocean.

Organisms, found in the plankton-gatherings of the »Antarctic» 1898.

In the following I give a list of all the organisms, found by me in the plankton-gathering, as well as the dates etc. for every form. By »Temp.» I denote the temperature of the water in centigrades, by »Sal.» the salinity pro mille, by »Fq.» the frequency, whether *rr*, very rare, *r* rare, + not rare, *c* common, *cc* very common, or *ccc* principal constituent of the plankton. The sign × denotes dead specimens. By »Pl.» I understand the ruling plankton-type viz.: *C* chætoplankton, *Ng* arctic neritic plankton, *Nm* southern neritic plankton, *Ns* northern neritic plankton, *S* styliplankton, *T* trichoplankton and *Tp* triposplankton.

Amphipoda.

Euthemisto libellula (Mandt).
Surface: 26. VII. 78° 13′ N. 7° 30′ E. Temp. 5,38. Sal. 34,89.

Cladocera.

Evadne Nordmannii Lovén.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
27 V	57° 50′	6° E.	8,70	33,69	*c*	*Tp Ns*
28 V	58° 14′	4° 40′ E.	8,8	31.83	+	*Ns Tp*
28 V	58° 41′	4° 34′ E.	8,30	33,04	+	*Ns Tp*
29 V	60° 13′	4° 24′ E.	8,35	33,32	+	*Ns Tp*
5 IX	71° 57′	19° E.	9,08	34,96	+	*Tp (Ns)*

E. spinifera P. F. Müll.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
27 V	57° 50′	6° E.	8,70	33.69	+	*Tp Ns*
29 V	60° 13′	4° 24′ E.	8,35	33,32	*r*	*Ns Tp*
30 V	63° 13′	5° 15′ E.	8,17	34,53	*c*	*Tp Ns*
30 V	63° 52′	6° 5′ E.	8	34,53	*c*	*Tp Ns*

Podon intermedius Lilljeb.

Surface: 27 V. Lat. N. 57° 50′. Long. 6° E. Temp. 8,70. Sal. 33,69. Fq. +. Pl. *Tp Ns.*

P. Leuckarti G. O. Sars.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
27 V	57° 50′	6° E.	8,70	33,69	*r*	*Tp Ns*
29 V	60° 13′	4° 24′ E.	8,35	33,32	+	*Ns Tp*

Copepoda.

Acartia Clausii Giesbr.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
27 V	57° 50′	6° E.	8,70	33,69	+	*Tp Ns*
28 V	58° 14′	4° 40′ E.	8,80	31,83	+	*Ns Tp*
28 V	58° 41′	4° 34′ E.	8,30	33,04	+	*Ns Tp*
30 V	63° 52′	6° 5′ E.	8	34,53	+	*Tp Ns*
1 VI	66° 42′	10° 30′ E.	8,53	34,69	*r*	*T S*
10 VI	71° 10′	21° 31′ E.	6,71	35,20	+	*C S*
5 IX	71° 57′	19° E.	9,08	34,96	+	*Tp (Ns)*
5 IX	71° 14′	19° 38′ E.	9,40	34,92	*r*	*Tp Ns*

A. longiremis (Lilljeb.).

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
27 V	57° 50′	6° E.	8,70	33,69	+	*Tp Ns*
28 V	58° 14′	4° 40′ E.	8,8	31,83	+	*Ns Tp*
28 V	58° 41′	4° 34′ E.	8,30	33,04	*c*	*Ns Tp*
29 V	60° 13′	4° 24′ E.	8,35	33,32	*c*	*Ns Tp*
30 V	63° 52′	6° 5′ E.	8	34,53	*r*	*Tp Ns*

Calanus finmarchicus (GUNN.).

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.	Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
27 V	57° 50′	6° E.	8,70	33,69	+	*Tp Ns*	21 VI	76° 27′	25° 55′ E.	0,24	33,68	*c*	(*C*)
28 V	58° 14′	4° 40′ E.	8,8	31,83	+	*Ns Tp*	23 VI	77° 15′	27° 10′ E.	0,97	33,15	*c*	(*C*)
28 V	58° 41′	4° 34′ E.	8,30	33,04	+	*Ns Tp*	25 VI	76° 34′	17° 24′ E.	0,6	33,80	+	
29 V	60° 13′	4° 24′ E.	8,35	33,32	+	*Ns Tp*	28 VIII	78° 23′	10° 23′ E.	6,06	34,94	*cc*	*T*
31 V	65° 34′	8° 45′ E.	8,83	35,00	*c*	*Ns T*	29 VIII	77° 23′	10° 53′ E.	5,55	35,03	*r*	*T S*
31 V	65° 47′	9° 10′ E.	9,01	34,67	+	*Ns Tp*	2 IX	75° 24′	16° 47′ E.	5,64	35,12	+	*T* (*S*)
1 VI	66° 42′	10° 30′ E.	8,53	34,69	*c*	*T Tp Ns*	3 IX	74° 16′	19° 10′ E.	2,83	34,36	*ccc*	*T*
2 VI	69° 15′	15° 25′ E.	7,35	34,23	*ccc*	*T*	4 IX	72° 43′	18° 43′ E.	8,8	35,01	*c*	*Tp Ns*
10 VI	71° 42′	22° 35′ E.	6,40	35,15	*cc*	*T C S*	4 IX	72° 29′	18° 48′ E.	8,87	35,04	*c*	*Tp Ns*
12 VI	73° 40′	22° 40′ E.	2,40	35,05	*c*	*C*	5 IX	71° 14′	19° 38′ E.	9,40	34,92	+	*Tp Ns*

Microsetella atlantica (BRADY & ROB.).

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
29 V	60° 13′	4° 24′ E.	8,35	33,32	*r*	*Ns Tp*
29 V	61° 40′	4° 20′ E.	7,05	33,47	*r*	*Ns Tp*
30 V	63° 52′	6° 5′ E.	8	34,53	*r*	*Tp Ns*
31 VIII	76° 12′	12° 18′ E.	6,26	35,15	*r*	*S*
3 IX	74° 42′	16° 42′ E.	7,24	35,17	*r*	*T* (*S*)
4 IX	72° 43′	18° 43′ E.	8,8	35,01	+	*Tp Ns*
4 IX	72° 29′	18° 48′ E.	8,87	35,04	*r*	*Tp Ns*
5 IX	71° 14′	19° 38′ E.	9,40	34,92	*r*	*Tp Ns*
6 IX	70° 33′	20° 32′ E.	9,37	34,41	*r*	*Tp Ns*

Oithona plumifera BAIRD.

Surface: 9 VI. Lat. N. 70° 59′. Long. E. 20° 43′. Temp. 7,15. Sal. 34,83. Fq. *rr*. Pl. *C* (*S*).

O. similis CLAUS.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.	Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
27 V	57° 50′	6° E.	8,70	33,69	*c*	*Tp Ns*	25 VIII	79° 53′	11° 22′ E.	2,77	33,75	+	*C* (*S*) *Ng*
30 VII	78° 12′	0° 17′ W.	4,59	34,53	+	*C*	28 VIII	78° 23′	10° 23′ E.	6,06	34,94	+	*T*
1 VIII	76° 36′	12° 8′ E.	7,38	35,12	+	*C T*	29 VIII	77° 38′	11° 40′ E.	6	34,89	*r*	*T S*
3 VIII	77° 46′	26° 18′ E.	1,23	30,98	+	*C* (*Ng*)	29 VIII	77° 23′	10° 53′ E.	5,55	35,03	*r*	*T S*
16 VIII	78° 27′	32° 30′ E.	1,52	33,46	+	(*C*) *Ng*	30 VIII	76° 45′	8° 45′ E.	5,34	34,92	*c*	*S*
19 VIII	80° 27′	30° 15′ E.	—0,90	32,03	*r*	(*Ng*)	31 VIII	76° 27′	10° 43′ E.	5,35	35,03	*r*	*S*
21 VIII	80° 31′	18° 50′ E.	2,42	33,93	*r*	*Ng T*	31 VIII	76° 12′	12° 18′ E.	6,26	35,15	*c*	*S*
24 VIII	80° 8′	16° 32′ E.	3,44	33,59	*r*	(*Ng*)	1 IX	76° 2′	13° 8′ E.	6,61	35,13	*c*	*S T*

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
2 IX	75° 50′	15° 32′ E.	5,52	35,01	*c*	*S T*
2 IX	75° 24′	16° 47′ E.	5,64	35,12	+	*T (S)*
3 IX	74° 42′	16° 42′ E.	7,24	35,17	*c*	*T (S)*
4 IX	73° 36′	18° 50′ E.	7,06	35,03	*c*	*S (Ns)*
4 IX	72° 43′	18° 43′ E.	8,8	35,01	+	*Tp Ns*
4 IX	72° 29′	18° 48′ E.	8,87	35,04	+	*Tp Ns*
5 IX	71° 57′	19° E.	9,08	34,96	*cc*	*Tp (Ns)*
5 IX	71° 14′	19° 38′ E.	9,40	34,92	*cc*	*Tp (Ns)*

Oncæa minuta Giesbr.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
29 VIII	77° 38′	11° 40′ E.	6	34,89	+	*T S*
29 VIII	77° 23	10° 53′ E.	5,55	35,03	+	*T S*
31 VIII	76° 12′	12° 18′ E.	6,26	35,15	*r*	*S*
4 IX	72° 43′	18° 43′ E.	8,8	35,01	*r*	*Tp Ns*
5 IX	71° 57′	19° E.	9,08	34,96	*r*	*Tp (Ns)*

Habitat: Mediterranean (Giesbr.). Eastern Atlantic: in 1898 March to May the Azores to Bretagne, west of Bergen and Lofoten; in July: Lat. N. 65°. Long. E. 1°—6°.

Pseudocalanus elongatus (Boeck).

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
29 V	61° 40′	4° 20′ E.	7,05	33,47	+	*Ns Tp*
25 VIII	79° 53′	11° 22′ E.	2,77	33,75	*r*	*C (S) Ng*

Temora longicornis (O. F. Müll.).

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
27 V	57° 50′	6° E.	8,70	33,69	*r*	*Tp Ns*
28 V	58° 41′	4° 34′ E.	8,30	33,04	+	*Ns Tp*
29 V	60° 13′	4° 24′ E.	8,35	33,32	*c*	*Ns Tp*
29 V	61° 40′	4° 20′ E.	7,05	33,47	*r*	*Ns Tp*
30 V	62° 41′	5° E.	7,47	33,12	*r*	*Ns Tp*
30 V	63° 52′	6° 5′ E.	8	34,53	*r*	*Tp Ns*

Ciliata.

Cyttarocylis denticulata (Ehb.). Brandt (Bibl. Zool. 1896) has some years ago split the *Tintinnus denticulatus* of Ehrenberg in several new species, which, however, seem to me to be mere varieties. But as it is of a certain importance for hydrography to distinguish also races I have tried to keep the forms separate. Around Spitzbergen was found, besides, a new variety *obtusa* (Aurivillius), which differs from var. *gigantea* by the apical end being rounded.

a. *typical C. denticulata.*

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
28 V	58° 14′	4° 40′ E.	8,8	31,83	*r*	*Ns Tp*
30 V	63° 52′	6° 5′ E.	8	34,53	+	*Tp Ns*
31 V	65° 47′	9° 10′ E.	9,01	34,67	*r*	*Ns Tp*
3 VIII	77° 46′	26° 18′ E.	1,23	30,98	*r*	(*Ng*)
15 VIII	77° 48′	32° 53′ E.	1,55	33,20	*r*	(*C*)
15 VIII	78° 38′	34° 30′ E.	1,52	34,30	*r*	*c*
16 VIII	78° 27′	32° 30′ E.	1,52	33,46	*r*	*Ng* (*C*)
29 VIII	77° 38′	11° 40′ E.	6	34,89	*r*	*T S*
31 VIII	76° 12′	12° 18′ E.	6,26	35,15	*r*	*S*
1 IX	76° 2′	13° 8′ E.	6,61	35,13	*r*	*T S*
2 IX	75° 24′	16° 47′ E.	5,64	35,12	*c*	*T* (*S*)
4 IX	73° 36′	18° 50′ E.	7,06	35,03	*r*	*S* (*Ns*)

b. *Var. edentula* (C. edentula Brandt).

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
26 VII	77° 53′	5° 3′ E.	4,78	34,57	*r*	(*C*)
30 VII	78° 12′	0° 17′ W.	4,59	34,53	*c*	(*C*)
31 VII	77° 14′	6° 34′ E.	5,35	34,77	*cc*	*S*
29 VIII	77° 38′	11° 40′ E.	6	34,89	*r*	*S T*
29 VIII	77° 23′	10° 53′ E.	5,55	35,03	*c*	*S T*
1 IX	76° 2′	13° 8′ E.	6,61	35,13	*c*	*S T*

c. *Var. gigántea* (C. gigantea Brandt).

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
29 V	61° 40′	4° 20′ E.	7,05	33,47	*r* ×	*Ns Tp*
30 V	62° 41′	5° E.	7,47	33,12	*r* ×	*Ns Tp*
30 V	63° 13′	5° 15′ E.	8,17	34,53	*r* ×	*Tp Ns*
31 V	65° 19′	8° 20′ E.	8,35	35,34	*r* ×	?

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.	Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
31 V	65° 34′	8° 45′ E.	8,83	35,00	*r*	*Ns T*	20 VIII	80° 45′	26° 40′ E.	0,13	32,20	*r*	(*Ng*)
1 VI	66° 42′	10° 30′ E.	8,53	34,69	*r* ×	*T Tp Ns*	28 VIII	78° 23′	10′ 23′ E.	6,06	34,94	*r*	*T* (*Ng*)
2 VI	68° 30′	13° 10′ E.	7,55	34,33	*r*	*Ns C*	29 VIII	77° 38′	11° 40′ E.	6	34,89	*r*	*T S*
11 VI	72° 10′	21° 46′ E.	5,53	35,25	*r* ×	(*C T*)	31 VIII	76° 27′	10° 43′ E.	5,35	35,03	*r* ×	*S*
12 VI	73° 40′	22° 40′ E.	2,40	35,05	*r*	*C*	1 IX	76° 2′	13° 8′ E.	6,61	35,13	*r*	*T S*
23 VI	77° 15′	27° 10° E.	0,97	33,15	*r*	(*C*)	2 IX	75° 50′	15° 32′ E.	5,52	35,01	*r* ×	*S T*
28 VII	77° 52′	3° 5′ W.	3,63	34,38	+	*C*	2 IX	75° 24′	16° 47′ E.	5,64	35,12	*c*	*T* (*S*)
3 VIII	77° 46′	26° 18′ E.	1,23	30,98	*c*	—	5 IX	71° 14′	19° 38′ E.	9,40	34,92	*c*	*Tp Ns*

d. *Var. media* (C. media Brandt).

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.	Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
30 V	62° 41′	5° E.	7,47	33,12	*rr*	*Ns Tp*	29 VIII	77° 38′	11° 40′ E.	6	34,89	*c*	*T S*
26 VII	78° 13′	7° 30′ E.	5,34	34,89	*r*	—	29 VIII	77° 23′	10° 53′ E.	5,55	35,03	*r*	*T S*
26 VII	77° 53′	5° 3′ E.	4,78	34,57	*r*	(*C*)	30 VIII	77°	8° 3′ E.	5,65	35,03	*r*	*T S*
30 VII	78° 12′	0° 17′ W.	4,59	34,53	+	*C*	30 VIII	76° 45′	8° 45′ E.	5,34	34,92	*r* ×	*S*
3 VIII	77° 3′	23° 35′ E.	3,94	34,45	*r*	(*C*)	31 VIII	76° 27′	10° 43′ E.	5,35	35,03	*r*	*S*
15 VIII	77° 48′	32° 53′ E.	1,55	33,20	*r*	(*C*)	31 VIII	76° 12′	12° 18′ E.	6,26	35,15	+	*S*
16 VIII	78° 27′	32° 30′ E.	1,52	33,46	*r*	*Ng* (*C*)	2 IX	75° 50′	15° 32′ E.	5,52	35,01	*r*	*S T*
20 VIII	81° 8′	23° 35′ E.	0,71	32,84	*r*	*Ng*	2 IX	75° 24′	16° 47′ E.	5,64	35,12	*c*	*T* (*S*)
21 VIII	80° 31′	18° 50′ E.	2,42	33,93	*r*	*Ng T*	3 IX	74° 42′	16° 42′ E.	7,24	35,17	*r*	*T* (*S*)
25 VIII	79° 53′	11° 22′ E.	2,77	33,75	+	*C* (*S*) *Ng*	4 IX	73° 36′	18° 50′ E.	7,06	35,03	*r*	*S* (*Ns*)
27 VIII	79° 58′	9° 35′ E.	4,53	34,53	*r*	*T*	4 IX	72° 43′	18° 43′ E.	8,8	35,01	*r*	*Tp Ns*
28 VIII	78° 23′	10° 23′ E.	6,06	34,94	*c*	*T*	5 IX	71° 57′	19′ E.	9,08	34,96	*r*	*Tp* (*Ns*)

e. *Var. obtusa* Auriv.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
21 VI	76° 27′	25° 55′ E.	0,24	33,68	*r*	(*C*)
3 VIII	77° 46′	26° 18′ E.	1,23	30,98	*r*	(*C*)
4 VIII	78° 18′	28° E.	2,12	33,01	*r*	*Ng C*
15 VIII	77° 48′	32° 53′ E	1,55	33,20	*r*	(*C*)
15 VIII	78° 38′	34° 30′ E.	1,52	33,21	+	*C*
16 VIII	78° 27′	32° 30′ R.	1,52	33,46	*c*	*Ng C*
18 VIII	79° 55′	32° 10′ E.	— 0,58	33,21	*r*	*Ng C*
19 VIII	80° 27′	30° 15′ E.	— 0,90	32,03	+	*Ng*

Fungella arctica Cl. N. Sp. By this name I propose to distinguish, provisionally, an organism, which, as I believe, belongs to the ciliate infusoria, but differs considerably from all known forms. Having had no opportunity of examining living specimens I am, at present, unable to characterize the new genus sufficiently. It seems to be nearest allied to the problematic Baltic form, designed by Hensen as »Sternhaarstatoblasten» and of which I have found some specimens in one of the hauls from Spitzbergen.

The Fig. 1, Pl. I represents on empty shell, which is very hyaline and structureless. The animal inhabits the central ovate cavity, which on alcohol-preserved specimens was quite filled by a granular mass.

Diam.: 0,18; height 0,096; diam. of the opening 0,028 mm.
Surface: 20. VIII. 80° 8′ N. 16° 32′ E. Temp. 3,44. Sal. 33,59.
Habitat: found recently on the coasts of Denmark, Holland and England.

Ptychocylis acuta BRANDT.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
1 VI	66° 42′	10° 30′ E.	8,53	34,69	*r* ×	*T Tp Ns*
28 VIII	78° 23′	10° 23′ E.	6,06	34,94	+	*T (Ng)*
29 VIII	77° 38′	11° 40′ E.	6	34,89	*r*	*S T*
31 VIII	76° 12′	12° 18′ E.	6,26	35,15	*c*	*S*
1 IX	76° 2′	13° 8′ E.	6,61	35,13	*c*	*S T*
2 IX	75° 50′	15° 32′ E.	5,52	35,01	+	*S T*
2 IX	75° 24′	16° 47′ E.	5,64	35,12	+	*T (S)*
3 IX	74° 42′	16° 42′ E.	7,24	35,17	*c*	*T (S)*
4 IX	73° 36′	18° 50′ E.	7,06	35,03	*r*	*S (Ns)*
4 IX	72° 43′	18° 43′ E.	8,8	35,01	+	*Tp Ns*
5 IX	71° 57′	19° E.	9,08	34,96	*r*	*Tp (Ns)*
5 IX	71° 14′	19° 38′ E.	9,40	34,92	*r*	*Tp Ns*

As the planktontype *Ns* is derived from *T*, it is from the above dates evident that this species belongs to the trichotype.

P. obtusa BRANDT. Being unable to distinguish between *P. obtusa* and *P. Drygalskii* BRANDT, I believe that the above name comprises both.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.	Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
12 VI	73° 40′	22° 40′ E.	2,40	35,05	*r*	*C*	20 VIII	80° 45′	26° 40′ E.	0,13	32,20	*r*	*Ng*
20 VI	74° 53′	20° 17′ E.	0,16	34,76	*r*	*C (Ng)*	20 VIII	81° 8′	23° 35′ E.	0,71	32,84	*c*	*Ng*
21 VI	76° 27′	25° 55′ E.	0,24	33,68	*r*	*(C)*	21 VIII	80° 31′	18° 50′ E.	2,42	33,93	+	*Ng T*
23 VI	77° 15′	27° 10′ E.	0,97	33,15	+	*(C)*	24 VIII	80° 8′	16° 32′ E.	3,44	33,59	*r*	*(Ng)*
25 VI	76° 34′	17° 24′ E.	0,6	33,80	+	—	25 VIII	79° 53′	11° 22′ E.	2,77	33,75	+	*C (S) Ng*
26 VII	78° 13′	7° 30′ E.	5,34	34,89	*r*	—	27 VIII	79° 58′	9° 35° E.	4,58	34,53	*r*	*T*
3 VIII	77° 46′	26° 18′ E.	1,23	30,98	*r*	*(C Ng)*	28 VIII	78° 23′	10° 23′ E.	6,06	34,93	*r*	*T (Ng)*
4 VIII	78° 18′	28° E.	2,12	33,01	+	*Ng C*	29 VIII	77° 38′	11° 40′ E.	6	34,89	*r*	*T C*
15 VIII	77° 48′	32° 53′ E.	1,55	33,20	+	*(C)*	29 VIII	77° 23′	10° 53′ E.	5,55	35,03	*c*	*T S*
15 VIII	78° 38′	34° 30′ E.	1,52	33,21	+	*C*	30 VIII	77°	8° 3′ E.	5,65	35,03	*r*	*S*
16 VIII	78° 27′	32° 30′ E.	1,52	33,46	*c*	*Ng C*	30 VIII	76° 45′	8° 45′ E	5,34	34,92	*r*	*S*
18 VIII	79° 55′	32° 10′ E.	— 0,58	33,21	*r*	*Ng C*	31 VIII	76° 27′	10° 43′ E.	5,35	35,03	+ ×	*S*
19 VIII	80° 27′	30° 15′ E.	— 0,90	32,03	*c*	*Ng*	3 IX	74° 42′	16° 42′ E.	7,24	35,17	*r*	*T (S)*
20 VIII	81° 14′	22° 50′ E.	0,38	33,42	+	*T*							

This species is evidently an arctic neritic form, characterizing the type *Ng*.

Tintinnus? calyptra Cl. N. sp. Shell irregularly conical. Opening not denticulate. End closed. Some few, obliquely transverse lines are visible, especially towards the opening. Structure: small, rounded alveoli, arranged nearly quincuncially.

Diam.: 0,04; height 0,09 mm. Pl. I, fig. 2.
Very rare: 31. VIII. 76° 27′ N. 10° 43′ E. Temp. 5,35. Sal. 35,03. Pl. *S.*

T. minutus Brandt. As I have seen no figure of this species I am somewhat uncertain about the identification. The form which I suppose to be *T. minutus* is figured in the Pl. I, fig. 3 and differs from *T. gracilis* Brandt in the less close teeth only, so that the above name probably comprises both. Diam. 0,03; height 0,05 mm.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
3 VIII	77° 46′	26° 18′ E.	1,23	30,98	*r*	(*C Ng*)
15 VIII	78° 38′	34° 30′ E.	1,52	33,21	+	*C*
21 VIII	80° 31′	18° 50′ E.	2,42	33,93	*r*	*Ng T*
25 VIII	79° 53′	11° 22′ E.	2,77	33,75	*r*	*C* (*S*) *Ng*
28 VIII	78° 23′	10° 23′ E.	6,06	34,94	*r*	*T* (*Ng*)
29 VIII	77° 38′	11° 40′ E.	6	34,89	+	*T S*
29 VIII	77° 23′	10° 53′ E.	5,55	35,03	+	*T S*
31 VIII	76° 27′	10° 43′ E.	5,35	35,03	*r*	*S*
1 IX	76° 2′	13° 8′ E.	6,61	35,13	+	*S T*
3 IX	75° 50′	15° 32′ E.	5,52	35,01	*r* ×	*S T*

T.? pellucidus Cl. N. sp. Shell a thin, structureless, irregular tube, which towards the wider opening has a number of close and fine, transverse lines. No foreign agglutinated bodies.

Diam. 0,04; height 0,24 mm. Pl. I, fig. 4.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
20 VIII	81° 14′	22° 50′ E.	1,18	33,42	*r*	*T*
20 VIII	81° 8′	23° 35′ E.	0,71	32,84	*r*	(*Ng*)
21 VIII	80° 31′	18° 50′ E.	2,42	33,93	*r*	*Ng T*
27 VIII	79° 58′	9° 35′ E.	4,58	34,53	*r*	*T*

T. secatus Brandt.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.	Date.	Lat. N.	Long.	Temp	Sal.	Fq.	Pl.
21 VIII	80° 31′	18° 50′ E.	2,42	33,93	*r*	*Ng T*	30 VIII	77°	8° 3′ E.	5,65	35,03	*r*	*S*
25 VIII	79° 53′	11° 22′ E.	2,77	33,75	*r*	*C* (*S*) *Ng*	31 VIII	76° 27′	10° 43′ E.	5,35	35,03	*r*	*S*
29 VIII	77° 38′	11° 40′ E.	6	34,89	*rr*	*S T*	1 IX	76° 2′	13° 8′ E.	6,61	35,13	*r*	*S T*
29 VIII	77° 23′	10° 53′ E.	5,55	35,03	+	*T S*							

Cystoflagellata.

Noctiluca miliaris Suriray.

28. V. Lat. N. 58° 41′. Long E. 4° 34′. Temp. 8,30. Sal. 33,04. Fq. *rr*. Pl. *Tp*.

Silicoflagellata.

Dictyocha speculum Ehb.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
31 VIII	76° 27′	10° 43′ E.	5,35	35,03	*r*	*S*
1 IX	76° 2′	13° 8′ E.	6,61	35,13	*rr*	*S T*

Radiolaria.

Acanthochiasma Krohnii Hkl.

5. IX. Lat. N. 71° 50′. Long E. 19° 2′. Haul 250—0 m. Fq. *rr*. Pl. *S*.

Acanthocorys umbellifera Hkl.

Deep-sea hauls:

Date.	Lat. N.	Long.	Depth.	Fq.	Pl.
1 VIII	76° 36′	12° 13′ E.	500—0 m.	*r*	*T S*
27 VIII	79° 58′	9° 35′ E.	400—0 »	*r*	*C S*
1 IX	75° 50′	15° 25′ E.	325—0 »	*r*	*S*
5 IX	71° 50′	19° 2′ E.	230—0 »	*r*	*S*

Habitat Mediterranean (Hkl.). Styliplankton of the warmer Atlantic. Färöe Channel (Cl.).

Acanthometron elasticum Hkl.

Surface: 31. VIII. Lat. N 76° 27′. Long E. 10° 43′. Temp. 5,35. Sal. 35,03. Fq. *rr*. Pl. *S*.

A. quadrifolium (Hkl.). — As I am unable to distinguish between *Acanthonia quadrifolia* and *Acanthometron catervatum* Hkl. the above name may comprise both. Also *Acanthometron siculum* does not seem to be anything but a larger and stouter form of the same species. In most samples with *A. quadrifol.* I have seen *Acanthostauros pallidus* (Clap. & Lachm.), which seems to me not to be anything but a younger form of

Acanthometron quadrifolium, as transitional forms exist. I therefore include this form in *A. quadrifolium*.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
4 IX	72° 43′	18° 43′ E.	8,8	35,01	*r*	*Tp Ns*
5 IX	71° 57′	19° E.	9,08	34,96	*c*	*Tp (Ns)*
5 IX	71° 14′	19° 38′ E.	9,40	34,92	*c*	*Tp Ns*
6 IX	70° 23′	20° 32′ E.	9,37	34,41	+	*Tp Ns*

Deep-sea hauls:

Date.	Lat. N.	Long.	Depth.	Fq.	Pl.
26–27 VII	77° 39′	1° 18′ E.	500—0 m.	*r*	*T S*
1 IX	75° 50′	15° 25′ E.	325—0 »	*r*	*S*

Acanthonia Mülleri Hkl.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
2 IX	75° 50′	15° 32 E.	5,52	35,01	*r*	*S T*
5 IX	71° 57′	19° E.	9,08	34,96	+	*Tp (Ns)*

Habitat: Mediterranean (Hkl.). — Styliplankton of the warmer Atlantic (Cl.).

Actinomma boreale Cl. N. sp.

a. *Primordial shell.* Thick walled, 0,06 mm. in diameter, with rounded, regular pores (0,003 to 0,005 mm. in diameter), two to three times broader than the bars, four on the radius. Spines in variable number, with triangular and forked apophyses half way to the apex. — Pl. I, fig. 5 *a*.

b. *Secundary (Haliomma-)shell.* Thick walled, 0,08 mm. in diameter, with rounded pores of unequal size (0,01 to 0,02 mm. in diameter), three to four on the radius. Bars 0,002 to 0,003 mm. thick. Spines in variable number, stout shorter than the radius, scattered at intervals. — Resembles *Haliomma beroes*. — Fig.: Pl. I, f. 5 *b*.

c. *Tertiary (Actinomma-)shell.* Thin walled, 0,1 to 0,12 mm. in diameter, with numerous, small (0,002 to 0,007 mm. in diameter), irregular rounded pores. Bars as broad as the pores. Spines numerous, scattered, half as long as the radius. — Fig.: Pl. I, f. 5 *c; d* structure.

Deep-sea hauls:

Date.	Lat. N.	Long.	Depth.	Fq.	Pl.
29—30 VII	78° 13′	2° 58′ W.	2,600—0 m.	*r*	*S C*
1 VIII	76° 36′	12° 13′ E.	500—0 »	*r*	*T S*
27 VIII	79° 58′	9° 35′ E.	400—0 »	*r*	*S C*
1 IX	75° 50′	15° 25′ E.	325—0 »	*r*	*S*
5 IX	71° 50′	19° 2′ E.	230—0 »	*r*	*S*

Artrostrobus annulatus (BAIL.) HKL. Pl. 1. f. 6.

Deep-sea hauls:

Date.	Lat. N.	Long.	Depth.	Fq.	Pl.
29—30 VII	78° 13′	2° 58′ W.	2,600—0 m.	*r*	*C S*
1 VIII	76° 36′	12° 13′ E.	500—0 »	*r*	*T S*

Habitat: Kamtschatka, Greenland.

Aulacantha lævissima HKL. As there exists no figure of this species in HAECKEL's monograph, I am somewhat uncertain about the identification. Length of radial tubes about 1 mm. breadth 0,0012—0,0015 mm.; length of tangential tubes about 0,18 mm. — Pl. I, fig. 7 *a* radial *b* tangential tubes.

Deep-sea haul: 29—30 VIII. Lat. N. 78° 13′. Long W. 2° 58′. 2,600—0 m. Fq. + — (Fragments).
Habitat: Färöe Channel.

Aulodendron antarcticum HKL. Detached spines perfectly agreeing with the figures in HAECKEL's monograph.

Deep-sea haul: 29—30 VII. Lat. N. 78° 13′. Long. W. 2° 58′. Fq. *r*.
Habitat: Kerguelen.

Auloscena spectabilis HKL. Fragments exactly agreeing with the figures in HAECKEL's monograph.

Deep-sea haul: 29—30 VII. Lat. N. 78° 13′. Long. W. 2° 58′. Fq. +.
Habitat: Antarctic Ocean (surface).

Beroetta melo CL. N. Sp. *Gen. char.* Family *Challengerida.* Shell without inner prominent tube of the mouth, with apical thoot but without marginal spines. Mouth simple, without peristome. Shell longitudinally furrowed. — *Sp. char.* Shell ovate. Length 0,09 mm. Breadth 0,05 mm. Longitudinal furrows 3 in 0,01 mm. Mouth 0,02 mm. in diameter.

Very rare in the deep-sea gathering: 29 – 30 VII. Lat. N. 78° 13′. Long. W. 2° 58. 2,600—0 m. Pl. I, f. 8.

Botryopyle setosa CL. N. S. Length 0,065 mm. Breadth 0,05 mm. Cephalis trilobate, with rounded, irregular pores and some scattered setæ. Thorax twice as long as the cephalis, with very irregular pores of different size.

Pl. I, f. 10 *a; b* Cephalis from below, showing the septum.

Deep-sea hauls:

Date.	Lat. N.	Long.	Depth.	Fq.	Pl.
29—30 VII	78° 13′	2° 58′ W.	500—0 m.	*r*	*S C*
1 VIII	76° 36′	12° 13′ E.	500—0 »	*r*	*T S*
27 VIII	79° 58′	9° 35′ E.	400—0 »	*r*	*C S*
1 IX	75° 50′	15° 25′ E.	325—0 »	*r*	*S*

Challengeria Harstonii J. MURRAY.

Deep-sea hauls:

Date.	Lat. N.	Long.	Depth.	Fq.	Pl.
29—30 VII	78° 13′	2° 58′ W.	2,600—0 m.	*r*	*S C*
27 VIII	79° 58′	9° 35′ E.	400—0 »	*r*	*S C*
1 IX	75° 50′	15° 25′ E.	325—0 »	*r*	*S*

Habitat: The abysmal depths east of Japan.

C. tridens HKL.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
29 VIII	77° 38′	11° 40′ E.	6	34,89	*r*	*T S*
1 IX	76° 2′	13° 8′ E.	6,61	35,13	*r*	*T S*

Deep-sea hauls:

Date.	Lat. N.	Long.	Depth.	Fq.	Pl.
29—30 VII	78° 13′	2° 58′ W.	2,600—0 m.	*r*	*C S*
27 VIII	79° 58′	9° 35′ E.	400—0 »	*r*	*C S*
1 IX	75° 50′	15° 25′ E.	325—0 »	*r*	*S*
5 IX	71° 50′	19° 2′ E.	230—0 »	*r*	*S*

Habitat: Färöe Channel.

Challengeron Nathorstii CL. N. sp. Shell ovate to subspherical, with a single spine at the apical pole, as long as the radius of the shell or longer. Diameter of the mouth half as long as the diameter of the shell. Structure: regular hexagonal alveoli, quincuncially arranged in obliquely decussating rows (3 in 0,01 mm.). Peristome finely punctate, with two long and pointed, hollow, almost parallel horns, and below each of them a triangular or ovate hole.

Diameter of the shell 0,06 to 0,08 mm. Pl. I, f. 9 *a*. Fig. 9 *b* structure.
The nearest relative is *C. diodon* from the south-eastern Pacific Ocean.

Deep-sea hauls:

Date.	Lat. N.	Long.	Depth.	Fq.	Pl.
27 VIII	79° 58′	9° 35′ E.	400—0 m.	*rr*	*S C*
5 IX	71° 50′	19° 2′ E.	230—0 »	*rr*	*S*

Habitat: Surface, 64° 25′ N.; 11° 50′ W. 10th March 1899.

Collozoum inerme (J. MÜLL.).

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
9 VI	70° 54′	20° 43′ E.	7,15	34,83	*r*	*C (S)*
10 VI	71° 10′	21° 31′ E.	6,71	35,20	*c*	*C S*
10 VI	71° 42′	22° 35′ E.	6,40	35,15	*r*	*T C*

Habitat: Cosmopolitan, common in all warmer seas (Mediterranean, Atlantic, Indian and Pacific) HÆCKEL. — Not rare in the styliplankton of the eastern Atlantic (CL.).

Cromyomma zonaster (Ehb). Thick walled and obscure, 0,11 mm. in diameter, densely covered with thin, flexible, radial spines, as long as the radius. Pores rounded 0,005 to 0,007 mm. in diameter; bars 0,003 to 0,005 mm. broad.

Deep-sea haul: 5. IX. Lat. N. 71° 50′. Long. E. 19° 2′. Fq. *rr*. Pl. *S*.

Habitat: Greenland, abysmal.

Dictyocephalus sp. In one of the deep-sea hauls was found one specimen (Pl. II, fig. 1) which perhaps may be *D. obtusus* or *Lophophœna obtusa* Ehb. Micrg. XXII, f. 40.

Dictyophimus gracilipes Bail. *Cephalis* hemispherical, with a single stout horn of variable length. Pores rounded. *Thorax* a three-sided smooth pyramide, with three decurrent ribs, prolonged in long, smooth three-sided feet. Pores rounded, irregular, decreasing in size towards the cephalis.

Cephalis 0,02 mm. long; horn 0,04—0,05 mm. Thorax 0,05 mm. long and 0,07 mm. broad. Pl. II, fig. 2.

Deep-sea hauls:

Date.	Lat. N.	Long.	Depth.	Fq.	Pl.
29—30 VII	78° 13′	2° 58′ W.	2,600—0 m.	*r*	*C S*
1 VIII	76° 36′	12° 13′ E.	500—0 »	*r*	*T S*
27 VIII	79° 58′	9° 35′ E.	400—0 »	*r*	*C S*
1 IX	75° 50′	15° 25′ E.	325—0 »	*r*	*S*

Habitat: Kamtschatka and the north Pacific Ocean.

Euphysetta Nathorstii Cl. N. sp. Shell ovate, with a single spine on the apical pole. Structure double: coarser longitudinal (9 in 0,01 mm.) and transverse (8 to 9 in 0,01 mm.) faint ribs crossing each other at right angles and, besides, very small puncta arranged in obliquely decussating rows (17 in 0,01 mm.). Peristome short and wide, with four slender articulate teeth, three of the same length but the fourth much longer. From the middle of the fourth tooht there issues in the middle a small spine.

Length 0,06 mm. Breadth 0,04 mm. Pl. II, fig. 3.
Deep-sea haul: 29—30 VII. Lat. N. 78° 13′. Long. W. 2 58′. Fq. *rr*. Depth 2,600—0 m.
Of the genus Euphysetta three species only are known, all from the tropical and southern Atlantic.

Euscenium tricolpium Hkl.

Deep-sea haul: 29—30 VII. Lat. N. 78° 13′. Long. W. 2° 58′. Fq. *rr*. Depth 2,600—0 m.

Habitat: Central Pacific Ocean, abysmal (Hkl.). — Northern Atlantic, between Shetlands and Norway, surface (March 1898 Cl.).

Gazelletta sp.

Fragments of the feet (smooth) were found in the deep-sea haul: 29—30 VII. Lat. N. 78° 13′. Long. W. 2° 58′. Depth 2,600—0 m.

Heliosphæra actinota Hkl.

One small specimen (Diam. 0,06 mm. Pores three on the radius, 0,013 mm. broad) in the deep-sea haul 29—30 VII. Lat. N. 78° 13′. Long. W. 2° 58′. 2,600—0 m.

Habitat: Mediterranean, Canaries, Azores (Hkl.).

Hexadoras borealis Cl. N. sp.

Primordial shell: irregularly spherical, 0,03 to 0,04 mm. in diameter, with irregular, rounded or polygonal pores, 2 to 3 on the radius, and thin bars. Spines six, exceptionally more, strong, with triangular apophyses in the middle. Pl. II, fig. 4 *a*.

Outer shell: a rounded or octahedric, more or less intricate net-work of anastomosing, silicious threads, issuing from the proximal edges of the spines. Spines usually six (rarely as in *Rhizoplegma* 8 to 10) strong, three-sided slightly spirally twisted, with elegantly aculeate, winged edges.

Diam. 0,12 to 0,16 mm. Spines 0,1 mm. Pl. II, fig. 4 *b, c*.

Deep-sea hauls:

Date.	Lat. N.	Long.	Depth.	Fq.	Pl.
1 VIII	76° 36′	12° 13′ E.	500—0 m.	*r*	*T S*
27 VIII	79° 58′	9° 35′ E.	400—0 »	*r*	*C S*
5 IX	71° 50′	19° 2′ E.	230—0 »	*r*	*S*

Habitat: North Atlantic, between Shetlands and Norway, surface, March 1898 (Cl.).

Litholophus ligurinus Hkl. (*L. arcticus* Auriv.).

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
26 VII	78° 13′	7° 30′ E.	5,34	34,89	*r*	—
27 VIII	79° 58′	9° 35′ E.	4,58	34,53	*r*	*T*
29 VIII	77° 23′	10° 53′ E	5,55	35,03	*r*	*S T*
31 VIII	76° 27′	10° 43′ E.	5,35	35,03	*r*	*S*
31 VIII	76° 12′	12° 18′ E.	6,26	35,15	*r*	*S*

Deep-sea hauls:

Date.	Lat. N.	Long.	Depth.	Fq.	Pl.
26—27 VII	77° 39′	1° 18′ E.	100—0 m.	+	*T S*
27 VIII	79° 58′	9° 35′ E.	400—0 »	*r*	*C S*

Habitat: Mediterranean, central Pacific Ocean (Hkl.).

Lithomitra australis (Ehb.)? The shell Pl. II, fig. 5 seems to be the upper joints of Eucyrtidium australe Ehb. from the South Polar ice (Microg. 35 A XXI, f. 18). It was found very rarely in the haul 29—30 VII. Lat. N. 78° 13′. Long. W. 2° 58′. 2,600—0 m.

Fig. 6, Pl. II represents a nearly related form from the same gathering.

L. lineata (Ehb.). Pl. II, fig. 7.

Deep-sea hauls:

Date.	Lat. N.	Long.	Depth.	Fq.	Pl.
29—30 VII	78° 13′	2° 58′ W.	2,600—0 m.	*r*	*C S*
27 VIII	79° 58′	9° 35′ E.	400—0 »	*r*	*C S*
5 IX	71° 50′	19° 2′ E.	230—0 »	*r*	*S*

Habitat: Mediterranean, Atlantic, Indian and Pacific Oceans (Hkl.).

Peridium (?) intricatum Cl. N. sp. Shell irregularly polyhedral, of a very loose and irregular frame-work with large, polygonal meshes, the apical being the largest. Basal plate with three large meshes of about the same size. Horn short.

Pl. II, fig. 8 *a* and *b* in different foci.
Diameter of the shell 0,08 mm.
Deep-sea haul: 29—30 VII. Lat. N. 78° 13′. Long. W. 2° 58′. 2,600—0 m. One single specimen.

P. (?) laxum Cl. N. sp. Shell irregularly polyhedral of a very loose frame-work, with large polygonal and irregular meshes, the apical being the largest. Basal plate with two cardinal and two jugular meshes of about the same size. Horn a fine bristle, half as long as the shell.

Pl. II, fig. 9 *a*, *b* (in different foci).
Diam. of the shell 0,05 mm.
Deep-sea haul: 5. IX. Lat. N. 71° 50′. Long. E. 19° 2′. 230—0 m. One single specimen.

P. (?) minutum Cl. N. sp. By this name I denote provisionally a very small shell, which perhaps might be the primordial shell of *Dictyophimus gracilipes* or *Acanthocorys umbellifera*, to which I have not yet succeeded in finding transitional forms. It is represented on the Pl. III, fig. 1 *a*, *b*, *c*, the two latter being the same shell in different foci. — The diameter of the shell 0,03 to 0,04 mm.

Deep-sea hauls:

Date.	Lat. N.	Long.	Depth.	Fq.	Pl.
23—30 VII	78° 13′	2° 58′ W.	2,600—2 m.	*r*	*C S*
27 VIII	71° 50′	9° 35′ E.	400—0 »	*r*	*C S*

Phorticium pylonium Hkl. To this variable and cosmopolitan species I refer the shell figured on the Pl. III, fig. 2 *a*, *b*, *c*. The fig. *d* represents the *primordial shell*, which occurs isolated in the deep-sea gatherings and bears a strong resemblance to *Haliomma æquorea* Ehb. (Microg. XIX, 51 from Aegina).

Deep-sea hauls:

Date.	Lat. N.	Long.	Depth.	Fq.	Pl.
29—30 VII	78° 13′	2° 58′ W.	2,600—0 m.	*r*	*S C*
1 VIII	76° 36′	12° 13′ E.	500—0 »	*r*	*T S*
27 VIII	79° 58′	9° 35′ E.	400—0 »	*r*	*C S*
1 IX	75° 50′	15° 25′ E.	325—0 »	*r*	*S*
5 IX	71° 50′	19° 2′ E.	230—0 »	*r*	*S*

Plectophora arachnoides (Clap. & Lachm.) Hkl. In this species I include also *Plagiacantha arachnoides* (Clap. & Lachm.) Hkl., which represents the young state. The net-work combining the spines is subject to great variation.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.	Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
10 VI	71° 10′	21°31′ E.	6,71	35,20	*r*	*C S*	1 IX	76° 2°	13° 8′ E.	6,61	35,13	*r*	*S T*
28 VIII	78° 23′	10°23′ E.	6,06	34,94	*r*	*T*	2 IX	75° 50′	15°32′ E.	5,52	35,01	+	*S T*
29 VIII	77° 38′	11°40′ E.	6	34,89	*r*	*T S*	2 IX	75° 24′	16° 47′ E.	5,64	35,12	*r*	*T (S)*
30 VIII	77°	8° 3′ E.	5,65	35,03	*r*	*S*	3 IX	74° 42′	16° 42′ E.	7,24	35,17	*r*	*T (S)*
30 VIII	76° 45′	8°45′ E.	5,34	34,92	*r*	*S*	4 IX	73° 36′	18°50′ E.	7,06	35,03	*r*	*S (Ns)*
31 VIII	76° 27′	10°43′ E	5,35	35,03	*r*	*S*	6 IX	70° 23′	20°32′ E.	9,37	34,41	*r*	*Tp (Ns)*
31 VIII	76° 12′	12°18′ E.	6,26	35,15	*r*	*S*							

Deep-sea hauls:

Date.	Lat. N.	Long.	Depth.	Fq.	Pl.
1 VIII	76° 36′	12° 13′ E.	500—0 m.	*r*	*T S*
27 VIII	79° 58′	9° 35′ E.	400—0 »	*r*	*C S*
1 IX	75° 50′	15° 25′ E.	325—0 »	*r*	*S*

Habitat: Coasts of Scotland and Norway. Newfoundland Banks (CL.).

Plectanium (?) simplex CL. N. sp. — Bars thin, cylindrical, each divided at the distal end into three branches, connected by thin threads into a delicate polyhedral network (Diam. 0,06 mm.).

Pl. III, fig. 3.
One single specimen in the haul 29—30 VII. Lat. N. 78° 13′. Long. W. 2° 58′. — 2,600—0 m.

Polypetta holostoma CL. N. sp. — Shell spherical. Structure: triangular alveoli (1,5 in 0,01 mm.) separated by prominent fine crests. At each point, where these crests cross each other, a short, small thorn arises. On the surface of the shell are scattered without order a number of narrow, structure-less, straight or slightly curved tubes, longer around the proboscis, where they are three to four times as long as the diameter of the shell. Proboscis a cylindrical tube, somewhat shorter than the diameter of the shell. The mouth with a narrow, undivided rim.

Diam. 0,09 to 0,1 mm.
Pl. III, fig. 4 *a*; *b* structure.
Deep-sea haul: 29—30 VII. Lat. N. 78° 13′. Lat. W. 2° 58′. — 2,600—0 m. *r*.
This species agrees in all respects, except the mouth, with *Polypetta tabulata* HKL. from the abysmal depth of the Indian Ocean.

Pterocorys irregularis CL. N. sp. — Cephalis nearly spherical, with one apical and one lateral horn. Its pores small and indistinct. Thorax with three strong, downwards directed horns, as long as the breadth of the thorax. Pores rounded, as broad as the bars, variable in size (0,002 to 0,006 mm. in diameter) and scattered without order. The upper part of the thorax provided with some few spines. Abdomen not distinctly separated from the thorax. Its pores similar to those of the thorax.

Length of cephalis 0,03, of thorax 0,07 mm., of abdomen 0,04 mm. Breadth of thorax 0,07 mm., of abdomen 0,08 mm.

Pl. IV, fig. 1.

The nearest allied form seems to be *P. columba*.

One specimen in the haul 29—30 VII. Lat. N. 78° 13′. Long. W. 2° 58′. — 2,600—0 m.

Habitat: Between Shetlands and Norway, surface, March 1898.

Sagenoscena penicillata Hkl. — Agrees with the description and figures in Hæckel's monograph with the exception that the radial rods have the same thickness as the tangential bars and are shorter than these, characteristics so trifling that I do not consider them sufficient for the distinction of a variety.

This species, known from the abysmal depths of the Antarctic Ocean, was found in fragments in the haul 29—30 VII. Lat. N. 78° 13′. Long. W. 2° 58′. — 2,600—0 m.

Sethoconus galea Cl. N. sp. — Shell campanulate or hemispherical, as long as broad (0,12 mm.), with rudimentary cephalis, not distinctly separated from the thorax. One apical spine and several small spines on the thorax. Pores irregularly polygonal, increasing in size from the apex, the largest 0,02 mm. in diameter.

Pl. IV, fig. 3.

Some few specimens in the haul 29—30 VII. Lat. N. 78° 13′. Long. W. 2° 58′. — 2,600—0 m.

Sethoconus tabulatus (Ehb.) Hkl.

Cephalis 0,013 mm. long. Thorax in length 0,06 mm., in breadth 0,045 mm. Largest pores 0,008 mm. in diameter. Cephalis with one delicate horn and several small bristles.

Pl. IV, fig. 2.

This species found by Ehrenberg in the abysmal depths of the Caribbean sea and by the Challenger Expedition in the abysmal depths between Ascension and Sierra Leone was found in the haul the 29—30 VII. Lat. N. 78° 13′. Long. W. 2° 58′. — 2,600—0 m.

Sethophormis sp.

A fragment of a species resembling *S. rotula* Hkl. was found in the haul 29—30 VII. Lat. N. 78° 13′. Long. W. 2° 58′. — 2,600—0 m.

Stichopilium davisianum (Ehb.). — Pl. IV, fig. 6.

Several specimens in the deep-sea hauls 29—30 VII. Lat. N. 78° 13′. Long. W. 2° 58′. — 2,600—0 m. and 1 IX. Lat. N. 75° 50′. Long. E. 15° 25′. — 325—0 m.

Habitat: Greenland, abysmal.

Theocalyptra cornuta Bail.

Length of cephalis 0,02, of thorax 0,08, of abdomen 0,01 mm. Diameter of the opening 0,14 mm. Diam. of the largest pores 0,014 mm.

Deep-sea hauls:

29—30 VII.	Lat. N.	78° 13′.	Long. W.	2° 58′.	Depth	2,600—0 m.	Fq. *r.*
27 VIII.	» »	79° 58′.	» E.	9° 35′.	»	400—0 »	» *r.*
1 IX	» »	75° 50′.	» »	15° 25′.	»	325—0 »	» *r.*

Habitat: Kamtschatka (Bail.), Greenland (Ehb.).

Theocorys borealis Cl. N. sp. — Cephalis hemisperical, with a short triangular horn and large, irregular, rounded pores. Thorax pear-shaped, with regular, circular

pores, as broad as the bars, quincuncially arranged (4 in 0,01 mm.). Abdomen short, narrower than the thorax, with some few, irregular and scattered pores. Mouth somewhat constricted, sometimes with a hyaline peristome.

Length of cephalis 0,015 mm., of thorax 0,03 mm., of abdomen 0,01 to 0,015 mm. Breadth of thorax 0,045 mm. Diameter of the mouth 0,027 mm.

Pl. III, fig. 5.

Resembles *Sethocorys odysseus* HKL. as to the shape and arrangement of the pores.

Deep-sea hauls:

Date.	Lat. N.	Long.	Depth.	Fq.	Pl.
29—30 VII	78° 13′	2° 58′ W.	2,600—0 m.	*r*	*S C*
27 VIII	79° 58′	9° 35′ E.	400—0 »	*r*	*C S*
1 IX	75° 50′	15° 25′ E.	325—0 »	*r*	*S*

Trochodiscus echinidiscus HKL.

Diam. of the shell 0,38 mm., of the pores 0,005 to 0,01 mm. Length of spines about a third of the radius.

Pl. IV, fig. 4.

One specimen in the deep-sea haul 29—30 VII. Lat. N. 78° 13′. Long. W. 2° 58′. — 2,600—0 m.

Habitat: Färöe Channel (HKL.).

T. helioides CL. N. sp. — Shell 0,24 mm. in diameter, with rounded pores (0,005 to 0,007 mm. in diameter), twice as broad as the bars. Margin with numerous, about 20, spines, as long as the diameter.

Pl. IV, fig. 5.

Haul 27 VII. Lat. N. 78° 58′. Long. E. 9° 35′. — 400—0 m.

Rhizopoda.

Globigerina bulloides D'ORB.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
29 VIII	77° 38′	11° 40′ E.	6	34,89	*r*	*T S*
30 VIII	77°	8° 3′ E.	5,65	35,03	*r*	(*S*)
30 VIII	76° 45′	8° 45′ E.	5,34	34,92	*r*	*S*
31 VIII	76° 27′	10° 43′ E.	5,35	35,03	*r*	*S*
31 VIII	76° 12′	12° 18′ E.	6,26	35,15	*r*	*S*
1 IX	76° 2′	13° 8′ E.	6,61	35,13	*r*	*S T*
2 IX	75° 50′	15° 32′ E.	5,52	35,01	*r*	*S T*
3 IX	74° 42′	16° 42′ E.	7,24	35,17	*r*	*T* (*S*)
4 IX	72° 43′	18° 43′ E.	8,8	35,01	*r*	*Tp Ns*
5 IX	71° 57′	19° E.	9,08	34,96	*r*	*Tp* (*Ns*)
5 IX	71° 14′	19° 38′ E.	9,40	34,92	*r*	*Tp Ns*
6 IX	70° 23′	20° 30′ E.	9,37	34,41	*r*	*Tp Ns*

Chlorophyllaceæ.

Halosphæra viridis SCHMITZ.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
27 V	57° 50′	6° E.	8,70	33,69	+	*Tp Ns*
30 V	63° 13′	5° 15′ E.	8,17	34,53	*r*	*Tp Ns*
4 IX	72° 43′	18° 43′ E.	8,8	35,01	*c*	*Tp Ns*
4 IX	72° 29′	18° 48′ E.	8,87	35,04	+	*Tp Ns*
5 IX	71° 57′	19° E.	9,08	34,96	*c*	*Tp (Ns)*
5 IX	71° 14′	19° 38′ E.	9,40	34,92	+	*Tp Ns*
6 IX	70° 23′	20° 32′ E.	9,37	34,41	*r*	*Tp Ns*

Flagellatæ.

Dinobryum pellucidum LEVANDER.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
26 VII	77° 39′	1° 18′ E.	5,07	32,22	*r*	—
28 VII	77° 52′	3° 5′ W.	3,63	34,38	*c*	—
15 VIII	77° 48′	32° 53′ E.	1,55	33,20	*r*	*(C)*
15 VIII	78° 38′	34° 30′ E.	1,52	33,21	+	*C*
16 VIII	78° 27′	32° 30′ E.	1,52	33,46	+	*Ng C*
18 VIII	79° 55′	32° 10′ E.	— 0,58	33,21	*r*	*Ng (C)*
20 VIII	80° 45′	26° 40′ E.	0,13	32,20	*r*	*Ng*
21 VIII	80° 31′	18° 50′ E.	2,42	33,93	*r*	*Ng T*
24 VIII	80° 8′	16° 32′ E.	3,44	33,59	+	*Ng*
25 VIII	79° 53′	11° 22′ E.	2,77	33,75	*r*	*C S Ng*
27 VIII	79° 58′	9° 35′ E.	4,58	34,53	*r*	*T*

Phæocystis Pouchetii LAGERH.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
11 VI	73° 3′	23° 28′ E.	5,15	35,37	*c*	*C*
12 VI	73° 40′	22° 40′ E.	2,40	35,05	*cc*	*C*
20 VI	74° 53′	20° 17′ E.	0,16	34,76	+	*C*
21 VI	76° 27′	25° 55′ E.	0,24	33,68	+	*(C)*
22 VI	76° 45′	26° E.	0,80	34,07	+	*(C)*
25 VI	76° 34′	17° 24′ E.	0,60	33,80	+	*((C))*
28 VII	77° 52′	3° 5′ W.	3,63	34,38	*c*	*C*
21 VIII	80° 31′	18° 50′ E.	2,42	33,93	+	*Ng T*
27 VIII	79° 58′	9° 35′ E.	4,58	34,53	+	*T*

Dinoflagellatæ.

Ceratium furca Duj

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.	Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
27 V	57° 50′	6° E.	8,70	33,69	+	*Tp Ns*	31 V	65° 47′	9° 10′ E.	9,01	34,67	*r*	*Ns Tp*
28 V	58° 14′	4° 40′ E.	8,8	31,83	+	*Ns Tp*	1 VI	66° 42′	10° 30′ E.	8,53	34,69	*c*	*T Tp Ns*
29 V	60° 13′	4° 24′ E.	8,35	33,32	+	*Ns Tp*	2 VI	68° 30′	13° 10′ E.	7,55	34,33	+	*Ns C*
30 V	62° 41′	5° E.	7,47	33,12	*r*	*Ns Tp*	2 VI	68° 49′	13° 50′ E.	7,70	34,16	+	*C Ns*
30 V	63° 13′	5° 15′ E.	8,17	34,53	+	*Tp Ns*	4 IX	72° 43′	18° 43′ E.	8,8	35,01	*c*	*Tp Ns*
30 V	63° 52′	6° 5′ E.	8	34,53	*c*	*Tp Ns*	5 IX	71° 57′	19° E.	9,08	34,96	*r*	*Tp (Ns)*
31 V	65° 19′	8° 20′ E.	8,35	35,34	*r*	—	5 IX	71° 14′	19° 38′ E.	9,40	34,92	*c*	*Tp Ns*
31 V	65° 34′	8° 45′ E.	8,83	35,00	+	*Ns T*	6 IX	70° 23′	20° 32′ E.	9,37	34,41	*c*	*Tp Ns*

C. fusus Duj.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.	Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
27 V	57° 50′	6° E.	8,70	33,69	+	*Tp Ns*	31 V	65° 47′	9° 10′ E.	9,01	34,67	*r*	*Ns Tp*
28 V	58° 14′	4° 40′ E.	8,8	31,83	*r*	*Ns Tp*	2 VI	68° 49′	13° 50′ E.	7,70	34,16	+	*C Ns*
28 V	58° 41′	4° 34′ E.	8,30	33,04	*r*	*Ns Tp*	4 IX	73° 36′	18° 50′ E.	7,06	35,03	*r*	*S (Ns)*
29 V	60° 13′	4° 24′ E.	8,35	33,32	*r*	*Ns Tp*	4 IX	72° 43′	18° 43′ E.	8,8	35,01	*r*	*Tp Ns*
30 V	62° 41′	5° E.	7,47	33,12	*r*	*Ns Tp*	5 IX	71° 14′	19° 38′ E.	9,40	34,92	+	*Tp Ns*
30 V	63° 13′	5° 15′ E.	8,17	34,53	+	*Tp Ns*	6 IX	70° 23′	20° 32′ E.	9,37	34,41	*r*	*Tp Ns*
31 V	65° 34′	8° 45′ E.	8,83	35,00	*r*	*Ns T*							

C. lineatum Ehb. (= *C. furca v. baltica* Moebius).

This form cannot be considered as a mere variety of *C. furca*, and is always easy to recognize. It belongs to the styliplankton of the warmer Atlantic, both in the East and the West. *C. furca* seems on the contrary to be confined to the east Atlantic.

Surface: 5 IX. Lat. N. 71° 50′. Long. E. 19° 2′. Fq. *rr*.

C. tripos Nitzsch.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.	Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
27 V	57° 50′	6° E.	8,70	33,69	+	*Tp Ns*	31 V	65° 34′	8° 45′ E.	8,83	35,00	*r*	*Ns T*
28 V	58° 14′	4° 40′ E.	8,8	31,83	*c*	*Ns Tp*	31 V	65° 47′	9° 10′ E.	9,01	34,67	+	*Ns Tp*
28 V	58° 41′	4° 34′ E.	8,30	33,04	*c*	*Ns Tp*	1 VI	66° 42′	10° 30′ E.	8,53	34,69	*c*	*T Tp Ns*
29 V	60° 13′	4° 24′ E.	8,35	33,32	*c*	*Ns Tp*	4 IX	72° 43′	18° 43′ E.	8,8	35,01	+	*Tp Ns*
29 V	61° 40′	4° 20′ E.	7,05	33,47	+	*Ns Tp*	4 IX	72° 29	18° 48′ E.	8,87	35,04	+	*Tp Ns*
30 V	62° 41′	5° E.	7,47	33,12	*c*	*Ns Tp*	5 IX	71° 57′	19° E.	9,08	34,96	+	*Tp (Ns)*
30 V	63° 13′	5° 15′ E.	8,17	34,53	*cc*	*Tp Ns*	5 IX	71° 14′	19° 38′ E.	9,40	34,92	*c*	*Tp Ns*
30 V	63° 52′	6° 5′ E.	8	34,53	*c*	*Tp Ns*	6 IX	70° 23′	20° 32′ E.	9,37	34,41	+	*Tp Ns*
31 V	65° 19′	8° 20′ E.	8,35	35,34	+	?							

C. tripos var. arctica Ehb. — I do not, as Dr. Aurivillius, include under this name also the *var. longipes*, which I find always easy to distinguish from the original form, figured in the Microgeologie and by Claparède and Lachmann. The var. *arctica* occurs frequently, sometimes in immense number, in the Labrador current, in Davis strait and around Spitzbergen (optimum salinity 34 p. m.). It belongs thus to the tricho-plankton chiefly, but occurs also in the sira-plankton. The var. *longipes*, on the contrary, is a more neritic form, which occurs in the spring along the whole Norwegian coast-line, around Scotland and in Skagerak. It belongs to the northern neritic plankton.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.	Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
10 VI	71° 10′	21° 31′ E.	6,71	35,20	*r*	*C S*	20 VIII	81° 8′	23° 35′ E.	0,71	32,84	*r*	*Ng*
10 VI	71° 42′	22° 35′ E.	6,40	35,15	*r*	*T C S*	21 VIII	80° 31′	18° 50′ E.	2,42	33,93	*c*	*Ng T*
26 VII	78° 13′	7° 30′ E.	5,34	34,89	*r*	—	24 VIII	80° 8′	16° 32′ E	3,44	33,59	*r*	*Ng*
26 VII	77° 53′	5° 3′ E.	4,78	34,57	*r*	((*C*))	25 VIII	79° 53′	11° 22′ E.	2,77	33,75	*r*	*C (S) Ng*
30 VII	78° 12′	0° 17′ W.	4,59	34,53	+	(*C*)	29 VIII	77° 38′	11° 40′ E.	6	34,89	*r*	*S T*
1 VIII	76° 36′	12° 8′ E.	7,38	35,12	+	*S T*	29 VIII	77° 23′	10° 53′ E.	5,55	35,03	*r*	*S T*
3 VIII	77° 46′	26° 18′ E.	1,23	30,98	*c*	(*C Ng*)	31 VIII	76° 12′	12° 18′ E.	6,26	35,15	*r*	*S*
4 VIII	78° 18′	28° E.	2,12	33,01	*r*	*Ng C*	1 IX	76° 2′	13° 8′ E.	6,61	35,13	*r*	*S T*
15 VIII	78° 38′	34° 30′ E.	1,52	33,21	+	*C*	2 IX	75° 50′	15° 32′ E.	5,52	35,01	*r*	*S T*
16 VIII	78° 27′	32° 30′ E.	1,52	33,46	+	*Ng C*	2 IX	75° 24′	16° 47′ E.	5,64	35,12	*r*	*T (S)*
18 VIII	79° 55′	32° 10′ E.	— 0,58	33,21	+	*Ng C*	3 IX	74° 42′	16° 42′ E.	7,24	35,17	+	*T (S)*
20 VIII	81° 14′	22° 50′ E.	1,18	33,42	*r*	*T*	4 IX	73° 36′	18° 50′ E.	7,06	35,03	*c*	*S (Ns)*
20 VIII	80° 45′	26° 40′ E.	0,13	32,20	*r*	(*Ng*)							

C. tripos var. bucephala Cl.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
27 V	57° 50′	6° E.	8,70	33,69	*r*	*Tp Ns*
5 IX	71° 57′	19° E.	9,08	34,96	*r*	*Tp (Ns)*

C. tripos var. horrida Cl.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
31 V	65° 19′	8° 20′ E.	8,35	35,34	*cc*	—
31 V	65° 34′	8° 45′ E.	8,83	35,00	+	*Ns T*
2 VI	68° 30	13° 10′ E.	7,55	34,33	*c*	*Ns C*
2 VI	68° 49′	13° 50′ E.	7,70	34,16	*c*	*C Ns*
10 VI	71° 10′	21° 31′ E.	6,71	35,20	*r*	*C S*
6 IX	70° 23′	20° 32′ E.	9,37	34,41	*c*	*Tp Ns*

C. tripos var. longipes Bail.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.	Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
27 V	57° 50′	6° E.	8,70	33,69	*cc*	*Tp Ns*	10 VI	71° 42′	22° 35′ E.	6,40	35,15	*r*	*T C S*
28 V	58° 14′	4° 40′ E.	8,8	31,83	*cc*	*Ns Tp*	15 VIII	77° 48′	32° 53′ E.	1,55	33,20	*r*	*(C)*
28 V	58° 41′	4° 34′ E.	8,30	33,04	*cc*	*Ns Tp*	20 VIII	81° 14′	22° 50′ E.	1,18	33,42	*r*	*T*
29 V	60° 13′	4° 24′ E.	8,35	33,32	*c*	*Ns Tp*	20 VIII	81° 8′	23° 35′ E.	0,71	32,84	*r*	*Ng*
29 V	61° 40′	4° 21′ E.	7,05	33,47	*cc*	*Ns Tp*	31 VIII	76° 12′	12° 18′ E	6,26	35,15	*r*	*S*
30 V	62° 41′	5° E.	7,47	33,12	*cc*	*Ns Tp*	1 IX	76° 2′	13° 8° E.	6,61	35,13	*r*	*S T*
30 V	63° 13′	5° 15′ E.	8,17	34,53	*cc*	*Tp Ns*	2 IX	75° 50′	15° 32′ E.	5,52	35,01	*r*	*S T*
30 V	63° 52′	6° 5′ E.	8	34,53	*cc*	*Tp Ns*	3 IX	74° 42′	16° 42′ E.	7,24	35,17	+	*T (S)*
31 V	65° 34′	8° 45′ E.	8,83	35,00	*cc*	*Ns T*	4 IX	73° 36′	18° 50′ E.	7,06	35,03	*c*	*S (Ns)*
31 V	65° 47′	9° 10′ E.	9,01	34,67	*c*	*Ns Tp*	4 IX	72° 43′	18° 43′ E.	8,8	35,01	*c*	*Tp Ns*
1 VI	66° 42′	10° 30′ E.	8,53	34,69	*c*	*T Tp Ns*	4 IX	72° 29′	18° 48′ E	8,87	35,04	*c*	*Tp Ns*
2 VI	68° 30′	13° 10′ E.	7,55	34,33	*c*	*Ns C*	5 IX	71° 57′	19° E.	9,08	34,96	*c*	*Tp (Ns)*
2 VI	68° 49′	13° 50′ E.	7,70	34,16	*c*	*C Ns*	5 IX	71° 14′	19° 38′ E.	9,40	34,92	*c*	*Tp (Ns)*
10 VI	71° 10′	21° 31′ E.	6,71	35,20	*r*	*C S*	6 IX	70° 23′	20° 32′ E.	9,37	34,41	*c*	*Tp (Ns)*

C. tripos var. macroceros Ehb.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
27 V	57° 50′	6° E.	8,70	33,69	*c*	*Tp Ns*
28 V	58° 14′	4° 40′ E.	8,8	31,83	*r*	*Ns Tp*
28 V	58° 41′	4° 34′ E.	8,30	33,04	+	*Ns Tp*
29 V	60° 13′	4° 24′ E.	8,35	33,32	+	*Ns Tp*
29 V	61° 40′	4° 20′ E.	7,05	33,47	*r*	*Ns Tp*
30 V	63° 13′	5° 15′ E.	8,17	34,53	*r*	*Tp Ns*
30 V	63° 52′	6° 5′ E.	8	34,53	*r*	*Tp Ns*
31 V	65° 47′	9° 10′ E.	9,01	34,67	*r*	*Ns Tp*
29 VIII	77° 38′	11° 40′ E.	6	34,89	*rr*	*T S*
4 IX	72° 43′	18° 43′ E.	8,8	35,01	*c*	*Tp Ns*
4 IX	72° 29′	18° 48′ E.	8,87	35,04	*c*	*Tp Ns*
5 IX	71° 57′	19° E.	9,08	34,96	*ccc*	*Tp (Ns)*
5 IX	71° 14′	19° 38′ E.	9,40	34,92	*c*	*Tp Ns*
6 IX	70° 23′	20° 32′ E.	9,37	34,41	*c*	*Tp Ns*

Dinophysis acuta Ehb.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
28 V	58° 14′	4° 40′ E.	8,8	31,83	*r*	*Ns Tp*
29 V	60° 13′	4° 24′ E.	8,35	33,32	*r*	*Ns Tp*
30 V	62° 41′	5° E.	7,47	33,12	*r*	*Ns Tp*
30 V	63° 52′	6° 5′ E.	8	34,53	*r*	*Tp Ns*
25 VIII	79° 53′	11° 22′ E.	2,77	33,75	*r*	*C (S) Ng*
6 IX	70° 23′	20° 32′ E	9,37	34,41	*rr*	*Tp Ns*

D. granulata Cl. — Under this name I distinguish a very small form (Pl. IV, fig. 7) remarkable for its coarse structure. It seems to belong to the arctic neritic plankton.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
26 VII	77° 53′	5° 3′ E.	4,78	34,57	*r*	((*C*))
30 VII	78° 12′	0° 17′ W.	4,59	34,53	+	(*C*)
19 VIII	80° 27′	30° 15′ E.	—0,90	32,03	*r*	*Ng*
20 VIII	80° 45′	26° 40′ E.	0,13	32,20	*r*	*Ng*
21 VIII	80° 31′	18° 50′ E.	2,42	33,93	*r*	*Ng*

D. rotundata. In several gatherings were found specimens, which could be considered as *D. rotundata*, but as I believe that several different forms have been confounded under this name, I leave them out.

Diplopsalis lenticula Bergh.

Deep-sea haul: 27 VII. Lat. N. 79° 58′. Long. E. 9° 35′. — 400—0 m. Rare.

Gonyaulax spinifera Clap. & Lachm.

Haul: 5 IX. Lat. N. 71° 50′. Long. E. 19° 2′. — 25—0 m. Rare.

Gymnaster pentasterias (Ehb.).

Haul: 27 VIII. Lat. N. 79° 58′. Long. E. 9° 35′. — 400—0 m. Rare.

Peridinium depressum (Bail.). — This form ought to be considered as a distinct species and not as a mere variety of *P. divergens*. The latter belongs to the tropical and temperate Atlantic (desmo-, styli- and triposplankton), the former to the northern and western Atlantic (tricho-, tripos- and northern neritic plankton).

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.	Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
27 V	57° 50′	6° E.	8,70	33,69	*c*	*Tp Ns*	1 VI	66° 42′	10′ 30′ E.	8,53	34,69	*cc*	*T Tp Ns*
28 V	58° 14′	4° 40′ E.	8,8	31,83	+	*Ns Tp*	2 VI	68° 30′	13° 10′ E.	7,55	34,33	+	*Ns C*
29 V	60° 13′	4° 24′ E.	8,35	33,32	*r*	*Ns Tp*	2 VI	68° 49′	13° 50′ E.	7,70	34,16	*r*	*C Ns*
30 V	62° 41′	5° E.	7,47	33,12	+	*Ns Tp*	2 IX	75° 50′	15° 32′ E.	5,52	35,01	+	*S T*
30 V	63° 13′	5° 15′ E.	8,14	34,53	+	*Tp Ns*	4 IX	73° 36′	18° 50′ E.	7,06	35,03	+	*S (Ns)*
30 V	63° 52′	6° 5′ E.	8,00	34,53	+	*Tp Ns*	4 IX	72° 43′	18° 43′ E.	8,80	35,01	*r*	*Tp Ns*
31 V	65° 19′	8° 20′ E.	8,35	35,34	+	—	6 IX	70° 23′	20° 32′ E.	9,37	34,41	+	*Tp Ns*
31 V	65° 47′	9° 10′ E.	9,01	34,67	+	*Ns Tp*							

P. divergens Ehb.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
29 VIII	77° 38′	11° 40′ E.	6	34,89	*r*	*S T*
4 IX	72° 43′	18° 43′ E.	8,8	35,01	*c*	*Tp Ns*
5 IX	71° 14′	19° 38′ E.	9,40	34,92	+	*Tp Ns*

P. ovatum Pouchet.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
29 V	61° 40′	4° 20′ E.	7,05	33,47	*r*	*Ns Tp*
30 V	63° 52′	6° 5′ E.	8	34,53	*r*	*Tp Ns*
31 V	65° 34′	8° 45′ E.	8,83	35,00	*r*	*Ns T*
31 V	65° 47′	9° 10′ E.	9,01	34,67	*r*	*Ns (Tp)*
1 VI	66° 42′	10° 30′ E.	8,53	34,69	+	*T Tp Ns*
2 VI	68° 30′	13° 10′ E.	7,55	34,33	*r*	*Ns C*
21 VI	76° 27′	25° 55′ E.	0,24	33,68	*r*	*(C)*
21 VIII	80° 31′	18° 50′ E.	2,42	33,93	*r*	*Ng*
29 VIII	77° 38′	11° 40′ E.	6	34,89	*r*	*T S*
31 VIII	76° 27′	10° 43′ E.	5,35	35,03	*r*	*S*
1 IX	76° 2′	13° 8′ E.	6,61	35,13	*r*	*S T*
2 IX	75° 50′	15° 32′ E.	5,52	35,01	*r*	*S T*
4 IX	72° 43′	18° 43′ E.	8,8	35,01	*r*	*Tp Ns*

P. pellucidum Bergh.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.	Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
21 VI	76° 27′	25° 55′ E.	0,24	33,68	+	*(C)*	18 VIII	79° 55′	32° 10′ E.	— 0,58	33,21	+	*Ng C*
25 VI	76° 34′	17° 24′ E.	0,6	33,80	+	—	19 VIII	80° 27′	30° 15′ E.	— 0,90	32,03	+	*Ng*
26 VI	76° 46′	15° 22′ E.	0,95	34,04	*r*	—	20 VIII	81° 14′	22° 50′ E.	1,18	33,42	*r*	*T*
26 VII	78° 13′	7° 30′ E.	5,34	34,89	*r*	—	20 VIII	80° 45′	26° 40′ E.	0,13	32,20	+	*(Ng)*
26 VII	77° 53′	5° 3′ E.	4,78	34,57	+	*((C))*	20 VIII	81° 8′	23° 35′ E.	0,71	32,84	*c*	*(Ng)*
30 VII	78° 12′	0° 17′ W.	4,59	34,53	*c*	*(C)*	21 VIII	80° 31′	18° 50′ E.	2,42	33,93	*c*	*Ng T*
3 VIII	77° 3′	23° 35′ E.	3,94	34,45	*r*	*(C)*	25 VIII	79° 53′	11° 22′ E.	2,77	33,75	+	*C (S) Ng*
3 VIII	77° 46′	26° 18′ E.	1,23	30,98	+	*C (Ng)*	29 VIII	77° 23′	10° 53′ E.	5,55	35,03	*c*	*T S*
4 VIII	78° 18′	28° E.	2,12	33,01	*c*	*Ng C*	31 VIII	76° 27′	10° 43′ E.	5,35	35,03	*c*	*S*
16 VIII	78° 27′	32° 30′ E.	1,52	33,46	+	*Ng C*	1 IX	76° 2′	13° 8′ E.	6,61	35,13	*c*	*S T*

Phalacroma operculoides Schütt.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
29 VIII	77° 38′	11° 40′ E.	6	34,89	*r*	*T S*
29 VIII	77° 23′	10° 53′ E.	5,55	35,03	*r*	*T S*
31 VIII	76° 27′	10° 43′ E.	5,35	35,03	*r*	*S*

Diatomaceæ.

Asteromphalus atlanticus Cl.

Deep-sea haul: 29—30 VII. Lat. N. 78′ 13°. Long. W. 2′ 58°. Depth. 500—0 m. Fq. *rr*.

Chætoceros atlanticus Cl.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
2 VI	68° 30′	13° 10′ E.	7,55	34,33	*r*	*Ns S*
12 VI	73° 40′	22° 40′ E.	2,40	35,05	*r*	*C*
15 VIII	78° 38′	34° 30′ E.	1,52	33,21	*r*	*C*
27 VIII	79° 58′	9° 35′ E.	4,58	34,53	*rr*	*T*
29 VIII	77° 38′	11° 40′ E.	6	34,89	*r*	*S T*
29 VIII	77° 23′	10° 53′ E.	5,55	35,03	*rr*	*S T*
30 VIII	76° 45′	8° 45′ E.	5,34	34,92	*rr*	*S*
1 IX	76° 2′	13° 8′ E.	6,61	35,13	*r*	*S T*
3 IX	74° 42′	16° 42′ E.	7,24	35,17	*r*	*T (S)*

C. borealis Btw.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
30 V	63° 13′	5° 15′ E.	8,17	34,53	*r*	*Tp Ns*
10 VI	71° 10′	21° 31′ E.	6,71	35,20	+	*C S*
12 VI	73° 40′	22° 40′ E.	2,40	35,05	*r*	*C*
23 VI	77° 15′	27° 10′ E.	0,97	33,15	*r*	*(C)*
3 VIII	77° 46′	26° 18′ E.	1,23	30,98	*r*	*(C)*
15 VIII	77° 48′	32° 53′ E.	1,55	33,20	*r*	*(C)*
15 VIII	78° 38′	34° 30′ E.	1,52	33,21	*c*	*C*
20 VIII	81° 14′	22° 50′ E.	1,18	33,42	*c*	*T*
20 VIII	81° 8′	23° 35′ E.	0,71	32,84	+	*Ng*
21 VIII	80° 31′	18° 50′ E.	2,42	33,93	+	*Ng*
25 VIII	79° 53′	11° 22′ E.	2 77	33,75	*r*	*C (S) Ng*
27 VIII	79° 58′	9° 35′ E.	4,58	34,53	*r*	*T*
1 IX	76° 2′	13° 8′ E.	6,61	35,13	*r*	*S T*
2 IX	75° 24′	16° 47′ E.	5,64	35,12	*r*	*T (S)*
4 IX	73° 36′	18° 50′ E.	7,06	35,03	+	*S (Ns)*

C. borealis var. Brightwellii Cl.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.	Date.	Lat. N.	Long.	Temp	Sal.	Fq.	Pl.
2 VI	68° 30′	13° 10′ E.	7,55	34,33	*rr*	*Ns C*	1 IX	76° 2′	13° 8′ E.	6,61	35,13	+	*S T*
10 VI	71° 42′	22° 35′ E.	6,40	35,15	+	*T C S*	2 IX	75° 24′	16° 47′ E.	5,64	35,12	*r*	*T (S)*
20 VIII	81° 14′	22° 50′ E.	1,18	33,42	*c*	*T*	3 IX	74° 42′	16° 42′ E.	7,24	35,17	*c*	*T (S)*
24 VIII	80° 8′	16° 32′ E.	3,44	33,59	*r*	*Ng*	4 IX	73° 36′	18° 50′ E.	7,06	35,03	*r*	*S (Ns)*
27 VIII	79° 58′	9° 35′ E.	4,58	34,53	+	*T*	4 IX	72° 43′	18° 43′ E.	8,8	35,01	*r*	*Tp Ns*
31 VIII	76° 12′	12° 18′ E.	6,26	35,15	*r*	*S*							

C. borealis var. solitaria Cl.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
9 VI	70° 54′	20° 43′ E.	7,15	34,83	+	*C S*
10 VI	71° 42′	22° 35′ E.	6,40	35,15	+	*T C S*
29 VIII	77° 23′	10° 53′ E.	5,55	35,03	+	*S T*
30 VIII	76° 45′	8° 43′ E.	5,34	34,92	*c*	*S*
31 VIII	76° 27′	10° 43′ E.	5,35	35,03	+	*S*
2 IX	75° 24′	16° 47′ E.	5,64	35,12	*r*	*T (S)*

C. contortus Schütt.

Deep-sea haul: 27 VIII. Lat. N. 79° 58′. Long E. 9° 35′. Depth 400—0 m. Fq. *r.*
5 IX. » » 71° 50′. » » 18° 2′. » 20—0 » » *r.*

C. criophilus Castr.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.	Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
2 VI	68° 30′	13° 10′ E.	7,55	34,33	*r*	*Ns C*	27 VIII	79° 58′	9° 35′ E.	4,58	34,53	*c*	*T*
2 VI	68° 49′	13° 50′ E.	7,70	34,16	*c*	*C Ns*	29 VIII	77° 38′	11° 40′ E.	6	34,89	+	*S T*
9 VI	70° 54′	20° 43′ E.	7,15	34,83	+	*C S*	29 VIII	77° 23′	10° 53′ E.	5,55	35,03	*c*	*S T*
10 VI	71° 10′	21° 31′ E.	6,71	35,20	*r*	*C S*	31 VIII	76° 12′	12° 18′ E.	6,26	35,15	+	*S*
10 VI	71° 42′	22° 35′ E.	6,40	35,15	*c*	*T C S*	1 IX	76° 2′	13° 8′ E.	6,61	35,13	*c*	*S T*
20 VIII	81° 14′	22° 50′ E.	1,18	33,42	*c*	*T*	2 IX	75° 24′	16° 47′ E.	5,64	35,12	*c*	*T (S)*
20 VIII	81° 8′	25° 35′ E.	0,71	32,84	+	*Ng*	3 IX	74° 42′	16° 42′ E.	7,24	35,17	+	*T (S)*
24 VIII	80° 8′	16° 32′ E.	3,44	33,59	*r*	*Ng*	4 IX	73° 36′	18° 50′ E.	7,06	35,03	*r*	*S (Ns)*
25 VIII	79° 53	11° 22′ E.	2,77	33,75	*r*	*C (S) Ng*							

C. debilis Cl.

Haul: 27 VIII. Lat. N. 79° 58′. Long E. 9° 35′. Depth 400—0 m. Fq. *r.*

C. decipiens Cl.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fp.	Pl.	Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
2 VI	68° 30′	13° 10′ E.	7,55	34,33	+	*Ns C*	30 VII	78° 12′	0° 17 W.	4,59	34,53	+	*(C)*
2 VI	68° 49′	13° 50′ E.	7,70	34,16	*c*	*C Ns*	3 VIII	77° 3′	23° 35′ E.	3,94	34,45	*r*	*(C)*
9 VI	70° 54′	20° 43′ E.	7,15	34,83	*c*	*C S*	3 VIII	77° 46′	26° 18′ E.	1,23	30,98	*c*	*C Ng*
10 VI	71° 10′	21° 31′ E.	6,71	35,20	+	*C S*	4 VIII	78° 18′	28° E.	2,12	33,01	*r*	*Ng C*
10 VI	71° 42′	22° 35′ E.	6,40	35,15	*c*	*C T S*	15 VIII	77° 48′	32° 53′ E.	1,55	33,20	+	*(C)*
11 VI	72° 10′	21° 46′ E.	5,53	35,25	+	*(C T)*	15 VIII	78° 38′	34° 30′ E.	1,52	33,21	*cc*	*C*
11 VI	73° 3′	23° 28′ E.	5,15	35,37	*c*	*C*	16 VIII	78° 27′	32° 30′ E.	1,52	33,46	*r*	*Ng C*
12 VI	73° 40′	22° 40′ E.	2,40	35,05	*cc*	*C*	18 VIII	79° 55′	32° 10′ E.	—0,58	33,21	*r*	*Ng C*
23 VI	77° 15′	27° 10′ E.	0,97	33,15	+	*(C)*	25 VIII	79° 53′	11° 22′ E.	2,77	33,75	+	*C (S) Ng*
26 VII	77° 53′	5° 3′ E.	4,78	34,57	+	*(C)*	27 VIII	79° 58′	9° 35′ E.	4,58	34,53	*r*	*T*
28 VII	77° 52′	3° 5′ W.	3,63	34,38	+	*C*	4 IX	72° 43′	18° 43′ E.	8,8	35,01	*r*	*Tp Ns*

C. diadema (Ehb.).

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
28 VII	77° 52′	3° 5′ W.	3,63	34,38	*r*	*C Ng*
20 VIII	81° 14′	22° 50′ E.	1,18	33,42	*r*	*T*
25 VIII	79° 53′	11° 22′ E.	2,77	33,75	+	*C (S) Ng*
27 VIII	79° 58′	9° 35′ E.	4,58	34,53	*c*	*T*
29 VIII	77° 38′	11° 40′ E.	6	34,89	+	*T S*
1 IX	76° 2′	13° 8′ E.	6,61	35,13	*r*	*T S*

C. furcellatus Bail.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
12 VI	73° 40′	22° 40′ E.	2,40	35,05	+	*C (Ng)*
26 VI	76° 46′	15° 22′ E.	0,95	34,04	*r*	—
28 VII	77° 52′	3° 5′ W.	3,63	34,38	*r*	*C Ng*
25 VIII	79° 53′	11° 22′ E.	2,77	33,75	+	*C (S) Ng*

C. hiemalis Cl. — The *C. didymus* var. *hiemalis* Cl. (Phytoplakton of the Atlantic 21, Pl. I, fig. 18) cannot be considered as a mere variety of *C. didymus*. Perhaps identical with *C. brevis* Schütt.

Surface: 1 IX. Lat. N. 76° 2′. Long. E. 13° 8′. Temp. 6,61. Sal. 35,13. Fq. *r*. Pl. *S T*.

C. laciniosus Schütt.

Deep-sea haul: 1 IX. Lat. N. 75° 50′. Long. E. 15° 25′. Depth. 325—0 m. Fq. *r*.

C. teres Cl.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
12 VI	73° 40′	22° 40′ E.	2,40	35.05	*r*	*C*
25 VIII	79° 53′	11° 22′ E.	2,77	33,75	+	*C (S) Ng*
27 VIII	79° 58′	9° 35′ E.	4,58	34,53	*r*	*T*
29 VIII	77° 38′	11° 40′ E.	6	34,89	*r*	*S T*

C. volans Schütt. — Having had an opportunity of examining original specimens of C. volans I have been convinced of its identity with *C. currens* Cl., which latter name must be abolishd.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
9 VI	70° 54′	20° 43′ E.	7,15	34,83	*c*	*C S*
31 VII	77° 14′	6° 34′ E.	5,35	34,77	*c*	*S*
1 VIII	76° 36′	12° 8′ E.	7,38	35,12	+	*S T*
29 VIII	77° 38′	11° 40′ E.	6	34,89	*r*	*T S*
29 VIII	77° 23′	10° 53′ E.	5,55	35,03	*c*	*T S*
30 VIII	77	8° 3′ E.	5,65	35,03	*c*	*S*
30 VIII	76° 45′	8° 45′ E.	5,34	34,92	*c*	*S*
31 VIII	76° 27′	10° 43′ E.	5,35	35,03	*cc*	*S*
2 IX	75° 24′	16° 47′ E.	5,64	35,12	+	*T (S)*

Corethron hystrix Hensen. — This species is probably identical with *C. criophilum* Castr. from the Antarctic Ocean. According to a recent publication of Dr. Leuduger Fortmorel * this species occurs West of Africa in the region of Cape Verde together with *Chætoceros scolopendra* Cl. (= *C. spinosum* Leud.). Both are found also by me in a gathering (March 1898) from the same region. In March and April 1898 this species was found, besides, in the region of the Canaries and from the Azores to the mouth of the English Channel, in June and July around the Shetlands. In case C. hystrix be identical with C. criophilum this form goes thus, following the western coast of Africa, from the Antarctic to the Arctic region. It has also (once in March 1898) been seen North of the South American coast, but not in the intermediate region of the Sargasso Sea. The *Corethron hystrix*, although in general of rare occurrence, is a species of considerable interest and belongs evidently to the styliplankton.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
29 VIII	77° 38′	11° 40′ E.	6	34,89	*rr*	*T S*
29 VIII	77° 23′	10° 53′ E.	5,55	35,03	*r*	*T S*
31 VIII	76° 26′	10° 43′ E.	5,35	35,03	*r*	*S*
1 IX	76° 2′	13° 8′ E.	6,61	35,13	*c*	*S T*
2 IX	75° 24′	16° 47′ E.	5,64	35,12	*r*	*T (S)*
6 IX	70° 23′	20° 32′ E.	9,37	34,41	*r*	*Tp Ns*

Coscinodiscus oculus iridis Ehb.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.	Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
30 V	63° 13′	5° 15′ E.	8,17	34,53	*r*	*Tp Ns*	23 VI	77° 15′	27° 10′ E.	0,97	33,15	*c*	*C T*
10 VI	71° 10′	21° 31′ E.	6,71	35,20	+	*C S*	3 VIII	77° 46′	26° 18′ E.	1,23	30,98	+	*C (Ng)*
12 VI	73° 40′	22° 40′ E.	2,40	35,05	*r*	*C*	15 VIII	78° 38′	34° 30′ E.	1,52	32,21	*r*	*C*
23 VI	77° 25′	27° 30′ E.	— 0,35	32,97	+	—	16 VIII	78° 27′	32° 30′ E.	1,52	33,46	*r*	*C Ng*
23 VI	77° 15′	27° 10′ E.	0,97	33,15	+	—	2 IX	75° 50′	15° 32′ E.	5,52	35,01	*r*	*T S*

* Diatomées marines de la côte occidentale d'Afrique. S:t Brieux 1898. 4:o.

Leptocylindrus danicus Cl.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
30 V	63° 13′	5° 15′ E.	8,17	34,53	*c*	*Tp Ns*
20 VIII	81° 14′	22° 50′ E.	1,18	33,42	*r*	*T*
20 VIII	81° 8′	23° 35′ E.	0,71	32,84	*r*	*Ng*
21 VIII	80° 31′	18° 50′ E.	2,42	33,93	*r*	*Ng T*
27 VIII	79° 58′	9° 35′ E.	4,58	34,53	*r*	*T*

Rhizosolenia alata Btw.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
30 VIII	76° 45′	8° 45′ E.	5,34	34,92	+	*S*
4 IX	72° 43′	18° 43′ E.	8,8	35,01	*r*	*Tp Ns*
5 IX	71° 57′	19° E.	9,08	34,96	*r*	*Tp (Ns)*

R(alata var.) gracillima Cl.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
31 VII	77° 14′	6° 34′ E.	5,35	34,77	*c*	*S*
25 VIII	79° 53′	11° 22′ E.	2,77	33,75	*r*	*C (S) Ng*
27 VIII	79° 58′	9° 35′ E	4,58	34,53	+	*T*
30 VIII	76° 45′	8° 45′ E.	5,34	34,92	*c*	*S*
31 VIII	76° 27′	10° 43′ R.	5,35	35,03	*r*	*S*
31 VIII	76° 12′	12° 18′ E.	6,26	35,15	+	*S*
4 IX	72° 43′	18° 43′ E.	8,8	35,01	*r*	*Tp Ns*
5 IX	71° 57′	19° E.	9,08	34,96	*c*	*Tp (Ns)*

R. hebetata Bail.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
27 VIII	79° 58′	9° 35′ E.	4,58	34,53	*r*	*T (S)*
29 VIII	77° 38′	11° 40′ E.	6	34,89	+	*T S*
29 VIII	77° 23′	10° 53′ E.	5,55	35,03	*r*	*T S*
30 VIII	77°	8° 3′ E.	5,65	35,03	*c*	*S*
30 VIII	76° 45′	8° 45′ E.	5,34	34,92	*c*	*S*
31 VIII	76° 27′	10° 43′ E.	5,35	35,03	*r*	*S*
31 VIII	76° 12′	12° 18′ E.	6,26	35,15	*r*	*S*
1 IX	76° 2′	13° 8′ E.	6,61	35,13	+	*S T*
2 IX	75° 24′	16° 47′ E.	5,64	35,12	+	*T (S)*
3 IX	74° 42′	16° 42′ E.	7,24	35,17	+	*T (S)*
5 IX	71° 57′	19° E.	9,08	34,96	*r*	*Tp (Ns)*

R. obtusa HENSEN.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
12 VI	73° 40′	22° 40′ E.	2,40	35,05	*r*	*C*
20 VIII	81° 14′	22° 50′ E.	1,18	33,42	+	*T*
20 VIII	81° 8′	23° 35′ E.	0,71	32,84	+	*Ng*
21 VIII	80° 31′	18° 50′ E.	2,42	33,93	+	*Ng T*
29 VIII	77° 38′	11° 40′ E	6	34,89	*r*	*T S*
29 VIII	77° 23′	10° 53′ E.	5,55	35,03	*c*	*T S*
31 VIII	76° 12′	12° 18′ E.	6,26	35,15	*r*	*S*
1 IX	76° 2′	13° 8′ E.	6,61	35,13	*r*	*S T*

R. semispina HENSEN.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
30 V	63° 13′	5° 15′ E.	8,17	34,53	*rr*	*Tp Ns*
9 VI	70° 54′	20° 43′ E.	7,15	34,83	+	*C S*
10 VI	71° 10′	21° 31′ E.	6,71	35,20	+	*C S*
10 VI	71° 42′	22° 35′ E.	6,40	35,15	*cc*	*T C S*
20 VIII	81° 14′	22° 50′ E.	1,18	33,42	*r*	*T*
30 VIII	77°	8° 3′ E.	5,65	35,03	*r*	*S*

R. styliformis BTW.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
27 V	57° 50′	6° E.	8,70	33,69	*r*	*Tp Ns*
30 V	63° 13′	5° 15′ E.	8,17	34,53	*rr*	*Tp Ns*
27 VIII	79° 58′	9° 35′ E.	4.58	34,53	*r*	*T (C)*
29 VIII	77° 38′	11° 40′ E.	6	34,89	*r*	*S T*
30 VIII	76° 45′	8° 45′ E.	5,34	34,92	+	*S*
2 IX	75° 50′	15° 32′ E.	5,52	35,01	*r*	*S T*
2 IX	75° 24′	16° 47′ E.	5,64	35,12	*r*	*T (S)*
3 IX	74° 42′	16° 42′ E.	7,24	35,17	*r*	*T (S)*
4 IX	73° 36′	18° 50′ E.	7,06	35,03	*c*	*S (Ns)*

Thalassiosira gravida CL.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.	Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
12 VI	73° 40′	22° 40′ E.	2,40	35,05	*r*	*C (Ng)*	25 VIII	79° 53′	11° 22′ E.	2,77	33,75	+	*C (S) Ng*
20 VIII	81° 14′	22° 50′ E.	1,18	33,42	+	*T*	27 VIII	79° 58′	9° 35′ E.	4,58	34,53	*c*	*T (S)*
20 VIII	81° 8′	23° 35′ E.	0,71	32,84	+	*Ng*	29 VIII	77° 38′	11° 40′ E	6	34,89	*r*	*T S*
21 VIII	80° 31′	18° 50′ E.	2,42	33,93	+	*Ng T*							

T. Nordenskiöldii Cl.

Surface:

Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
25 VI	76° 34′	17° 24′ E.	0,6	33,80	+	((*C*))
28 VII	77° 52	3° 5′ E.	3,63	34,38	*r*	*C* (*Ng*)

Thalassiothrix longissima Cl. & Grun.

Surface:

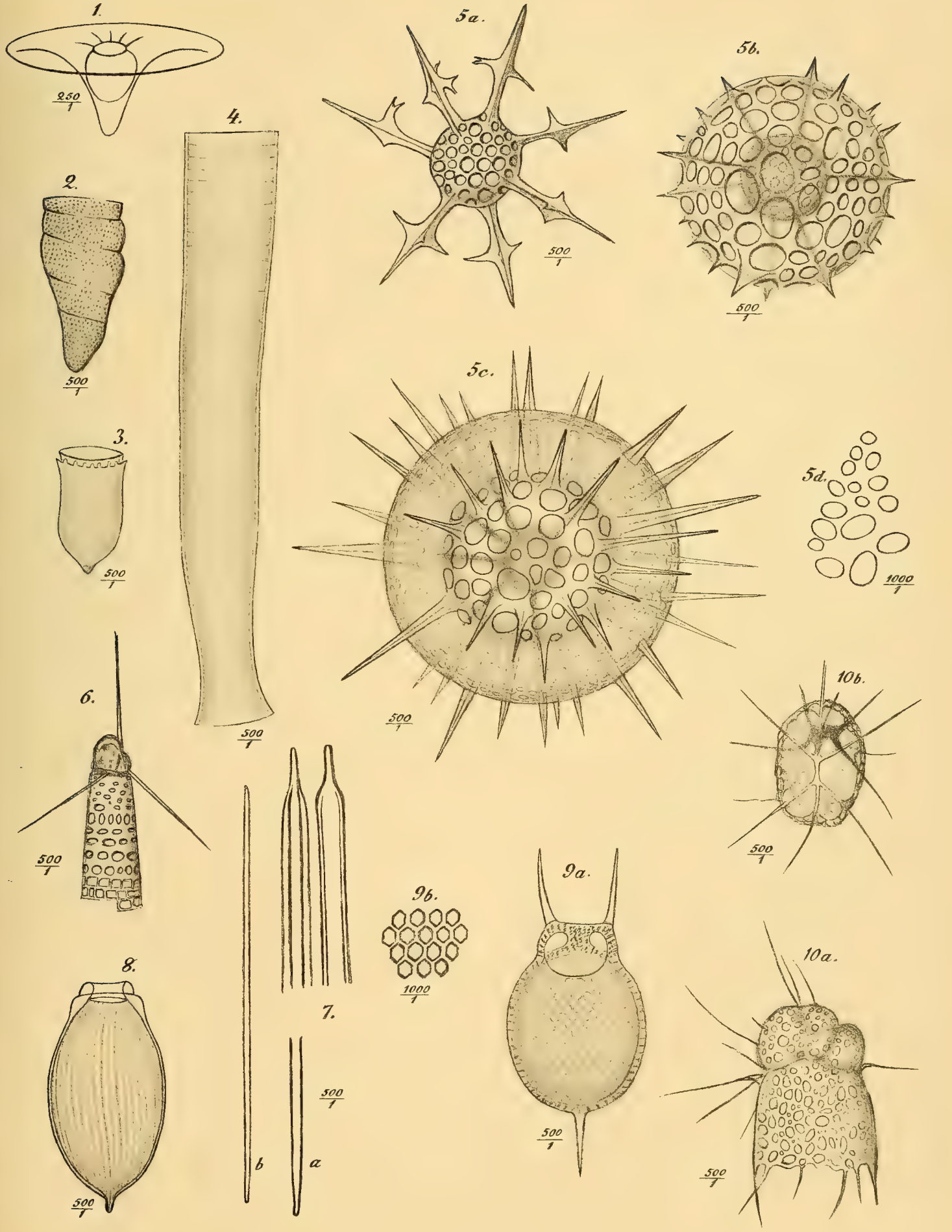
Date.	Lat. N.	Long.	Temp.	Sal.	Fq.	Pl.
10 VI	71° 10′	21° 31′ E.	6,71	35,20	*r*	*C S*
31 VIII	76° 12′	12° 18′ E.	6,26	35,15	*r*	*S*
1 IX	76° 2′	13° 8′ E.	6,61	35,13	*r*	*S T*
3 IX	74° 42′	16° 42′ E.	7,24	35,17	+	*T* (*S*)

The scarcity in 1898 of this and the precedent species, in other years usually very abundant in the Arctic Ocean and the Northern Atlantic, is really striking.

Plate I.

Pag.

Fig. 1. Fungella arctica Cl. . . . . 22.
» 2. Tintinnus (?) calyptra Cl. . . . . 24.
» 3. Tintinnus minutus Brandt . . . . . 24.
» 4. Tintinnus (?) pellucidus Cl. . . . . 24.
» 5. Actinomma boreale Cl. *a* Primordial shell, *b* Secundary (Haliomma-)shell, *c* Tertiary (Actinomma-) shell, *d* Structure of *c* . . . . . 26.
» 6. Artrostrobus annulatus Bail. . . . . 27.
» 7. Aulacantha lævissima Hkl. . . . . 27.
» 8. Beroetta melo Cl. . . . . 27.
» 9. Challengeron Nathorstii Cl. *a* Entire shell, *b* Structure . . . . . 28.
» 10. Botryopyle setosa Cl. *a* Shell, *b* Septum . . . . . 27.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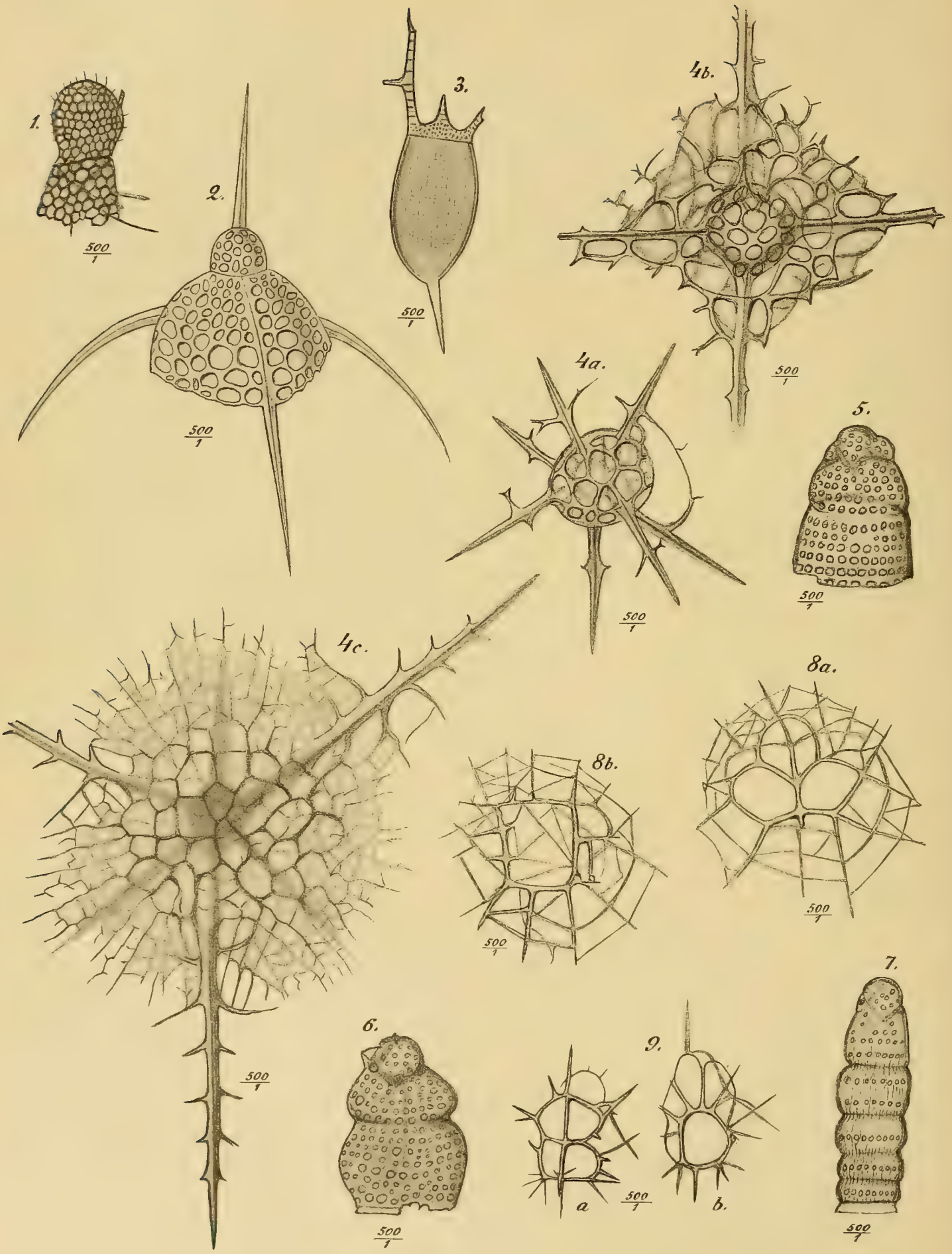
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Plate II.

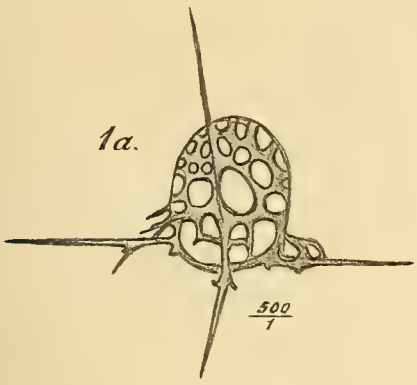
Pag

Fig. 1. Dictyocephalus sp.? . . . . . 29.
2. Dictyophimus gracilipes BAIL. . . . . 29.
3. Euphysetta Nathorstii CL. . . . . 29.
4. Hexadoras borealis CL. *a* Primordial shell, *b* and *c* Outer shell in different state of development 30.
5. Lithomitra australis EHB.? . . . . . 30.
6. Form allied to the precedent . . . . . 30.
7. Lithomitra lineata EHB. . . . . 30.
8. Peridium (?) intricatum CL. *a* and *b* The shell in different foci . . . . . 31.
9. Peridium (?) laxum CL. *a* and *b* The shell in different foci . . . . . 31.

Plate III.

Pag.

Fig. 1. Peridium (?) minutum Cl. *b* and *c* The same shell in different foci . . . . . 31.
» 2. Phorticium pylonium Hkl. *a*, *b*, *c* The shell in different state of development, *d* The primordial shell . . . . . 31.
» 3. Plectanium (?) simplex Cl. . . . . 32.
» 4. Polypetta holostoma Cl. *a* The shell, *b* Structure . . . . . 32.
» 5. Theocorys borealis Cl. . . . . 33.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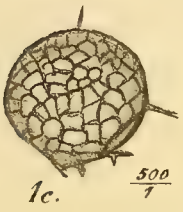
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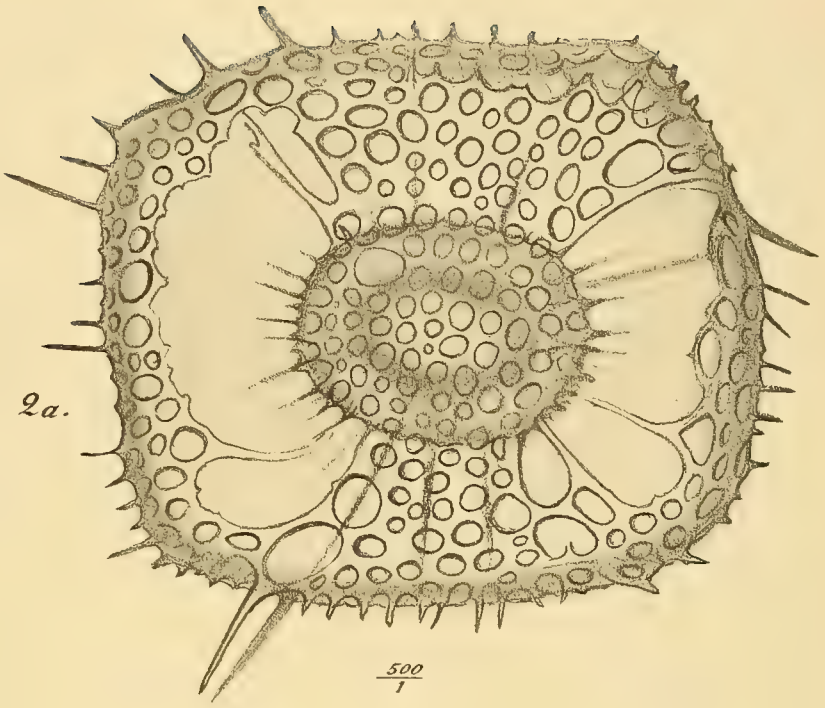
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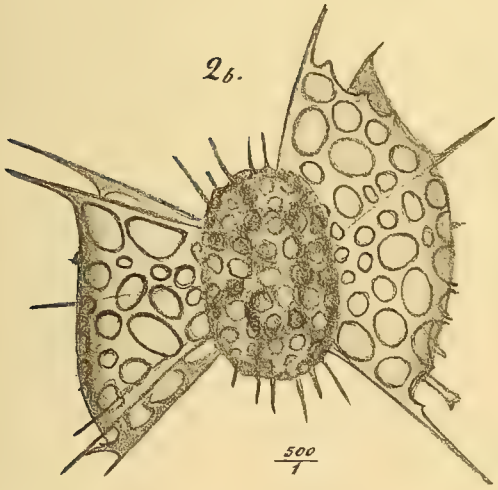
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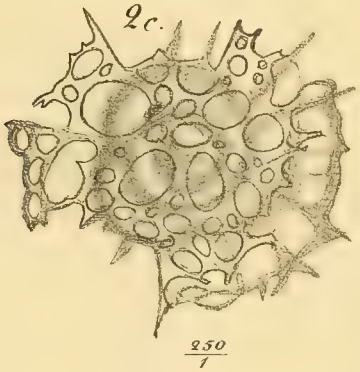
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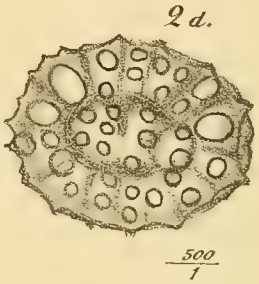
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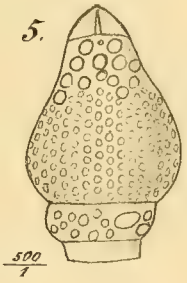
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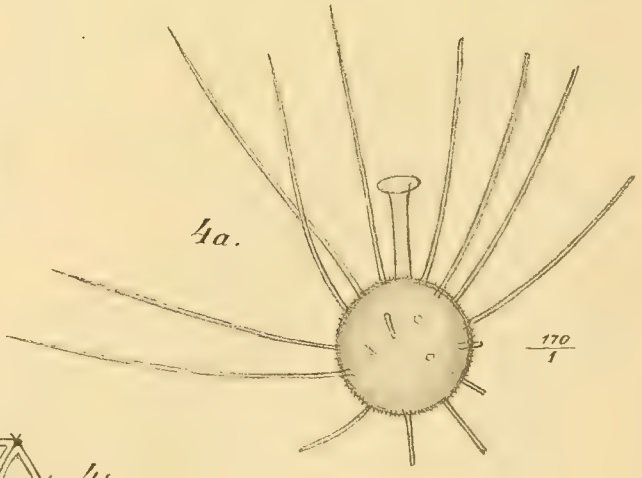
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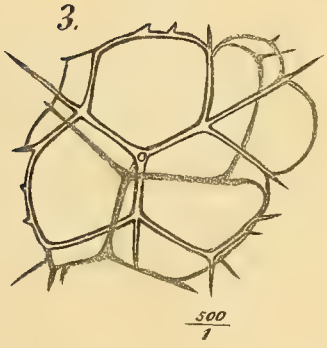
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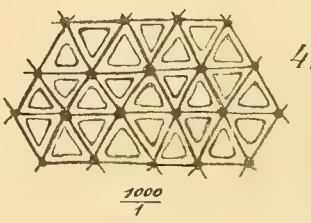
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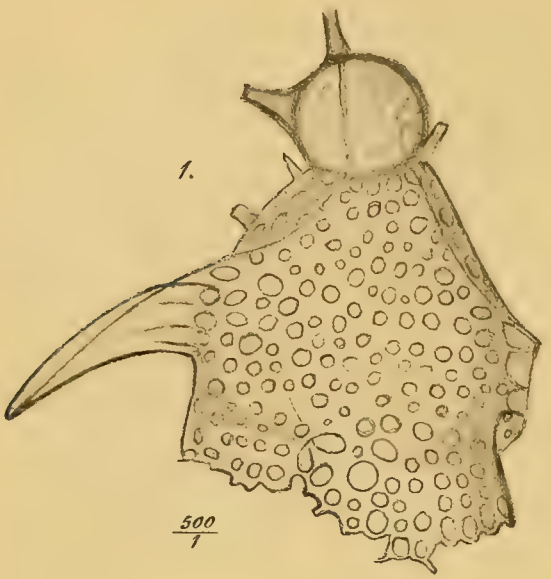
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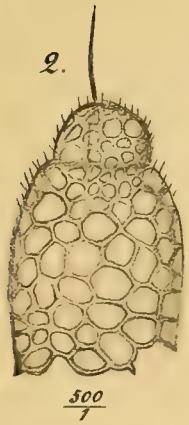
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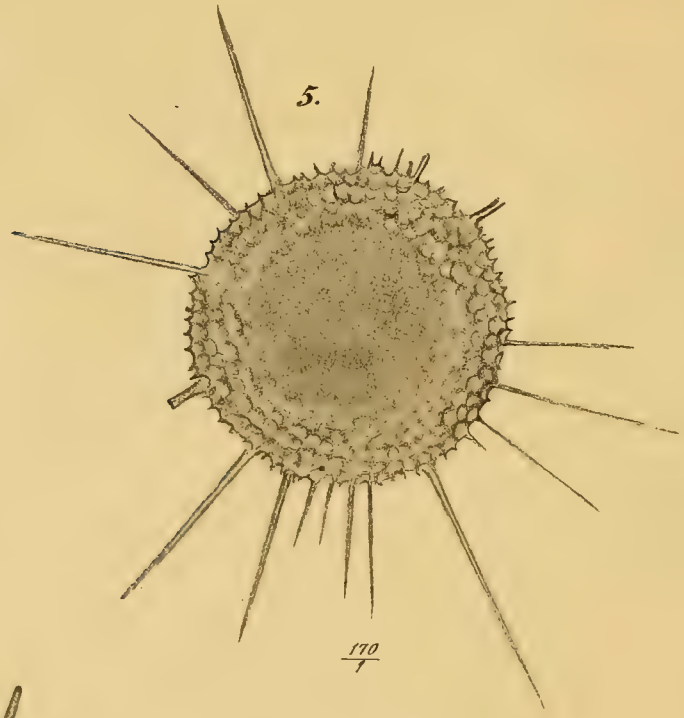
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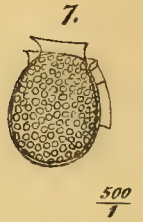
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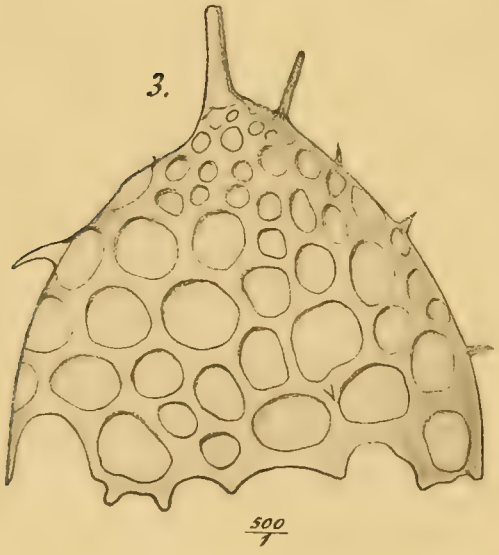
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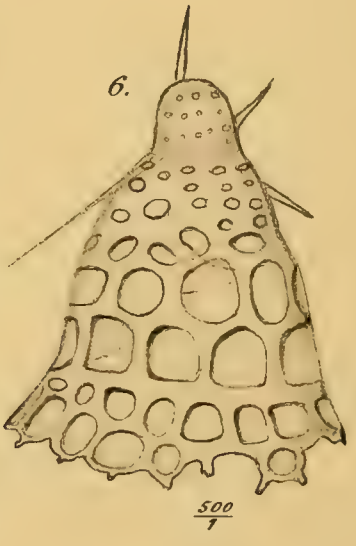
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Plate IV.

Pag.

Fig. 1. Pterocorys irregularis Cl. . . . . 32.
» 2. Sethoconus tabulatus (Ehb.) . . . . . 33.
» 3. Sethoconus galea Cl. . . . . 33.
» 4. Trochodiscus echinidiscus Hkl. 34
» 5. Trochodiscus helioides Cl. . . . . 34.
» 6. Stichopilium davisianum (Ehb.) 33
» 7. Dinophysis granulata Cl. . . . . 39.

KONGL. SVENSKA VETENSKAPS-AKADEMIENS HANDLINGAR. Bandet 32. N:o 4.

QUELQUES RECHERCHES

SUR

LES CENTRES D'ACTION DE L'ATMOSPHÈRE

II. LA PLUIE

PAR

H. HILDEBRAND HILDEBRANDSSON.

AVEC 4 PLANCHES.

MÉMOIRE PRÉSENTÉ A L'ACADÉMIE ROYALE DES SCIENCES DE SUÈDE LE 12 AVRIL 1899.

STOCKHOLM
KUNGL. BOKTRYCKERIET. P. A. NORSTEDT & SÖNER
1899

Dans la première partie de cet ouvrage[1] nous avons étudié les écarts des moyennes barométriques mensuelles. Nous y avons trouvé, entre autres choses, qu'il existe une relation intime entre les écarts des différentes régions de la terre, surtout entre des centres d'action voisins. Ainsi les variations barométriques aux Açores et dans les parages de l'Islande sont presque toujours *opposées*, c.-à-d. que si la pression de l'air est plus haute ou plus basse qu'en moyenne aux Açores, c'est l'inverse qui a lieu simultanément sur la mer entre l'Islande et l'Écosse. La même opposition se retrouve aussi entre la Sibérie occidentale et l'Alaska, et entre Tahiti et les parages du Cap Horn.

En comparant, d'un autre côté, les courbes des Açores et de la Sibérie, nous trouvions une *concordance* assez remarquable, surtout en hiver.

Quant aux régions intermédiaires elles sont influencées par les centres d'action avoisinants. Le centre de l'Europe est en général en concordance avec les Açores, mais la région Baltique est la plus irrégulière de toutes, influencée tantôt par les Açores ou par la Sibérie, tantôt par l'Islande. De même l'Inde, située entre la Sibérie et la haute pression de l'Océan Indien, est influencée des deux côtés, mais l'opposition avec la Sibérie semble être prépondérante.

Depuis lors nous avons étendu ces recherches à un autre élément météorologique, *la pluie*, l'élément d'un côté le plus important pour l'économie des nations et, d'un autre, le plus variable et en apparence le plus irrégulier de tous. En effet, il suffit de parcourir quelques registres météorologiques pour voir immédiatement que les sommes mensuelles d'eau tombée sont très variables. Un mois pluvieux est immédiatement suivi d'un mois sec, et dans les diverses régions d'un même pays les conditions sont souvent très différentes. Un mois est donc évidemment un laps de temps trop court pour notre but. Mais si l'on considère les saisons ou une demi-année, octobre—mars ou avril—septembre, on rencontre au contraire une régularité surprenante. En conséquence nous ne donnons dans les tableaux que contient ce mémoire que les moyennes pour les semestres, pour octobre—mars et pour avril—septembre et pour l'année. Remarquons que la demi-année octobre—mars est plus facile à étudier que l'autre, avril—septembre, car en été il y a de grandes

[1] K. Svenska Vet.-Akad. Handl. Bd. 29. N:o 3. 1897.

espaces, surtout dans les régions subtropicales de l'hémisphère boréal, auxquelles la pluie fait souvent défaut pendant plusieurs mois.

1. Avant de discuter la distribution simultanée de la pluie du point de vue qui nous occupe, il faut bien se souvenir qu'il y a trois espèces de pluie, à savoir: *pluie de convection*, *pluie cyclonique* et *pluie orographique*. La dernière espèce est causée par la formation du sol. C'est par conséquent un phénomène local. Ainsi une chaîne de montagne située perpendiculaire aux vents dominants aura un régime de pluie différent sur ses deux versants. Nous en avons un exemple bien net dans la partie boréale de la péninsule scandinave. Par les tableaux et par les diagrammes 1—3 Pl. I[1] on voit que la variation d'une année à l'autre dans la somme annuelle de pluie est sensiblement la même tout le long de la côte du Golfe de Bothnie de Haparanda à Upsala. L'allure des courbes pour Upsala, Umeå et Haparanda est en effet presque la même, tandis que l'allure des courbes pour Tromsö et Christiansund, situées sur la côte norvégienne, est presque tout à fait opposée.

Pareille opposition existe aussi quoique moins nette entre les côtes occidentale et orientale de l'Écosse. Montrose (Pl. I, diagr. 4) est situé à peu près au milieu de la côte est. En tirant une ligne de là à peu près perpendiculairement aux directions des montagnes, on rencontre le phâre Kyleakin sur la côte opposée. On voit que les deux courbes pour ces lieux sont en général opposées. Cependant les années très pluvieuses 1877 et 1882 font des exceptions.

En étudiant le régime des pluies dans les fjords et entre les îlots des côtes sud-ouest et sud de la Norvège et de la côte sud-ouest de l'Écosse on rencontre des phénomènes très singuliers et tout à fait locaux. Des phénomènes analogues s'offrent à nous dans d'autres parties du monde. A Ceylan, p. ex., les saisons des pluies sont opposées sur les côtes nord-est et sud-ouest, chaque côte ayant sa saison des pluies quand la mousson souffle de la mer vers le rivage. Aux Philippines le régime des pluies des différents îlots a été une question climatologique des plus compliquées.

De même, dans le Nord de l'Europe, l'Écosse et la partie boréale de la Scandinavie ont des régimes de pluie à eux, qui diffèrent tout à fait des régimes généraux de notre partie du monde. Aussi forment-ils comme des barrières entre ces régimes généraux. De la mer de la Norvège s'étend, entre l'Ecosse et la Scandinavie, la mer du Nord continuée par les plaines du Danemark, du sud de la Suède et de l'Allemagne boréale. Toute cette vaste étendue a sensiblement le même régime, comme on le voit par les courbes de Thorshavn, du Danemark et de Berlin (Pl. I, diagr. 7—9). Les valeurs pour le Danemark sont la somme des pluies annuelles pour Fanö, Vestervig et Copenhague en Danemark et Halmstad sur la côte sud-ouest de la Suède. En fait les trois courbes présentent une concordance assez bonne. La région Baltique, représentée par Kalmar à la côte suédoise et Libau à la côte opposée russe (voir les tableaux), est une région intermédiaire entre le centre d'action océanique, dont nous venons de parler, et le centre d'action asiatique.

Dans les recherches suivantes nous sommes donc obligés d'éviter les régions de la même espèce que la partie boréale de la Suède, c'est-à-dire les régions où l'on aura à

[1] Dans ce mémoire, comme dans le précédent, les courbes sont tirées selon des échelles différentes afin que l'amplitude soit sensiblement la même partout.

craindre une influence orographique prépondérante sur la chûte d'eau. Comme nous l'avons dit, cette influence est la plus grande quand une chaîne de montagne est dirigée perpendiculairement aux vents dominants. Si au contraire sa direction est parallèle aux vents dominants, son influence est beaucoup moindre et souvent sans importance. Les courbes annuelles pour Bregenz et Riva, p. ex., (Pl. I, diagr. 5 et 6), font voir une concordance assez bonne (l'année 1877 fait exception), car la direction des Alpes est en général parallèle aux vents dominants de l'ouest. Pourtant Bregenz est situé au nord des Alpes sur le Lac de Constance, et Riva, au sud des Alpes, au bord du Lac de Garde; deux points appartenant à des climats très différents.

2. *Octobre—mars.* Étant obligés, comme nous l'avons dit plus haut, de nous borner à des périodes plus longues qu'un mois, le manque d'observations devient de plus en plus sensible, et le nombre des centres d'action que nous pouvons utiliser devient très restreint. Ni de l'Alaska, ni du Cap Horn nous n'avons d'observations suffisantes. Ce que nous avons, c'est en première ligne les trois centres autour de l'Europe: La mer d'Islande, les Açores et la Sibérie.

La Pl. II nous donne les diagrammes (10) pour l'Islande et les Açores. La somme pour octobre 1875—mars 1876 est inscrite sous l'année *1876* et ainsi de suite, toujours sous l'année *suivante*. Le centre de l'Islande est la somme de Thorshavn, Berufjord et Tromsö, et celui des Açores est la somme de Ponta Delgada, San Fernando et Madrid. Le diagramme fait voir *que les variations dans les quantités d'eau tombée pendant la saison froide des différentes années sont presque toujours opposées.* En effet, il n'y a guère que l'année 1880 (octobre 1879—mars 1880) qui fasse exception. Par conséquent, nous avons retrouvé la même opposition entre ces deux centres d'action que nous avons trouvée pour les écarts mensuels de la pression de l'air.

Les diagrammes 11 et 12, Pl. II, pour la Sibérie occidentale et l'Inde, sont d'une certaine importance. Dans son Memorandum on the snowfall in the mountain districts of Northern India for 1898 M. Eliot donne les nombres suivants indiquant les écarts de la quantité moyenne annuelle de pluie tombée sur toute l'Inde pour les années 1876—1897:

Année.	Écarts (pouces).	Per cent.	Année.	Écarts (pouces).	Per cent.
1876	— 4.49	— 11	1887	+ 2.42	+ 6
1877	— 4.28	— 11	1888	— 1.54	— 4
1878	+ 6.34	+ 15	1889	+ 2.41	+ 6
1879	+ 1.69	+ 4	1890	+ 0.68	+ 1
1880	— 1.56	— 4	1891	— 3.54	— 9
1881	+ 0.10	0	1892	+ 5.09	+ 12
1882	+ 2.64	+ 6	1893	+ 9.07	+ 22
1883	— 0.12	0	1894	+ 6.47	+ 16
1884	+ 1.73	+ 4	1895	— 2.90	— 7
1885	+ 1.05	+ 3	1896	— 4.83	— 12
1886	+ 3.02	+ 7	1897	— 0.15	0

Nous avons représenté ici ces nombres par un diagramme et l'avons comparé avec la pluie (ou plutôt la neige) tombée pendant octobre—mars en Sibérie occidentale représentée par la somme de Barnaul et de Énisseisk. *On voit que les allures de ces courbes sont presque tout à fait opposées.*

Mais la précipitation annuelle dans l'Inde se compose, sauf aux stations les plus boréales, presque exclusivement de la pluie de la mousson du sud-ouest, et elle arrive pendant l'été. *Or, la quantité d'eau tombée d'octobre à mars en Sibérie est en général inverse à la quantité qui va tomber pendant la saison des pluies suivante dans l'Inde.*

Les météorologistes à Calcutta ont observé depuis longtemps que si la quantité de neige est abondante en hiver sur les montagnes de Himalaya, on a à craindre la sécheresse et la famine dans l'Indoustan pendant l'année suivante, et, au contraire, s'il y a peu de neige en hiver on peut espérer une pluie de mousson abondante. Chaque printemps M. ELIOT publie un »Memorandum» sur l'état de la neige pendant l'hiver passé avec une prévision à longue échéance du caractère général de la saison des pluies suivante. Évidemment, la relation entre l'eau tombée en Sibérie en hiver et dans l'Inde pendant l'été suivant est la même que celle observée à Calcutta entre la neige sur les montagnes en hiver et la quantité de pluie suivante. De là on pourrait conclure qu'en hiver le régime de pluie est le même sur toute l'Asie centrale depuis l'intérieur de la Sibérie au nord jusqu'aux sommets de l'Himalaya et aux montagnes du Béloutschistan au sud.

Il est évident qu'une prévision du temps pendant la saison des pluies dans l'Inde, faite six mois à l'avance, serait d'une utilité enorme. De la pluie de mousson dépend l'état économique de centaines de millions d'hommes, pour lesquelles il s'agit du bien-être ou de la misère ou de la famine. Il y a plus: l'état des choses dans l'Inde se fait sentir d'une manière redoutable à Londres et dans toute l'Europe et y a souvent provoqué des crises financières des plus terribles. Malheureusement il y a des exceptions à la loi émise plus haut. Des 21 années qu'embrassent nos diagrammes il en est au moins deux, 1886 et 1896, qui font positivement défaut, et par surcroît l'une d'elles, 1896, était l'une des plus importantes à cause de la sécheresse et de la famine qui sévirent alors dans l'Inde.

Dans la première partie nous avons constaté que les fluctuations du baromètre dans l'Inde sont en général opposées, d'un côté à celles de la Sibérie et de l'autre à celles de l'observatoire de Maurice, situé dans le centre d'action de l'Océan Indien. Cependant la marche inverse était plus prononcée entre l'Inde et la Sibérie qu'entre l'Inde et l'Océan Indien. La courbe pour Maurice (octobre—mars) Pl. II, 12, n'est pourtant guère en relation quelconque avec la courbe pour l'Inde; il n'y a ni concordance ni opposition. Remarquons cependant que la sécheresse dans l'Inde en 1896 a été précédée en février par la chûte en Maurice de la quantité d'eau jusqu'alors inouïe de 762.1 mm. Du reste une relation entre Maurice et l'Inde serait plus probable en été où l'alizé du SE. et la mousson du SO. forment entre les deux endroits un seul courant d'air des plus puissants, qu'en hiver, où l'alizé du SE. et la mousson du NE. forment deux courants presque opposés, séparés par des calmes équatoriaux.

Par le même diagramme (12) on voit qu'il y a une opposition bien nette entre la pluie à Maurice et celle au sud de l'Australie. Cette dernière courbe représente la somme de Melbourne et d'Auckland dans l'île nord de la Nouvelle Zélande.[1]

Malheureusement il n'y a pas d'observation pour S:te Hélène dans le centre d'action de l'Atlantique sud. Cependant Madame BEHRENS a mesuré pendant plusieurs années l'eau tombée à sa villa, Alto da Serra, en Brésil (Lat. 23° 40′ S., Long. 46° 30′ O. Gr.). Cette place étant située encore sous le régime de la haute pression de l'Atlantique sud, j'ai comparé les mesures de Mme BEHRENS, publiées dans SYMONS *Meteorological Magazine* (1888, p. 59), avec les mesures simultanées faites à Cordoba dans le climat tempéré de la République Argentine. On retrouve (Pl. II, diagr. 13) la même allure opposée qu'entre le maximum de l'Atlantique nord et le minimum des parages de l'Islande et entre le maximum de l'Océan Indien et les régions tempérées du Sud de l'Australie.

Ainsi nous avons retrouvé, autant que le permettent les observations malheureusement trop peu nombreuses, la même opposition entre les centres d'action à haute pression barométrique et ceux à basse pression situés au nord et au sud des premiers, que nous trouvions dans la première partie de cette ouvrage pour la pression de l'air.

Là nous constations aussi, surtout pour l'hiver, une concordance assez remarquable entre les courbes des Açores et de la Sibérie. Ici la Pl. III (diagr. 17—24) fait voir qu'il y a une très grande ressemblance entre l'allure des courbes d'un grand nombre de stations depuis les Açores tout le long de l'Europe centrale jusque dans la Sibérie occidentale. Vers le nord ce régime existe encore à Greenwich. De l'autre côté, à Zi-ka-wei sur les côtes de Chine nous rencontrons encore une opposition bien tranchée. Il est vraiment surprenant de voir ainsi une ressemblance remarquable entre le régime des pluies aux parages de l'Islande et sur les côtes de la Chine. En effet, il n'y a guère que 1879 qui fasse exception.

Du minimum de la mer de Behring nous n'avons pas d'observations. Sapporo à Jesso est pourtant évidemment situé dans une région intermédiaire entre ce centre d'action et les parages de la Chine (voir les tableaux).

Sur la Pl. IV (diagr. 25—28) on trouve quelques courbes de stations de l'Amérique du Nord depuis Honolulu dans l'Océan Pacifique jusqu'à Key West, au sud de Floride. Il y a une bonne concordance entre San Diego, Saint-Louis et New York (voir aussi les tableaux), mais et Honolulu et Key West appartiennent à des régimes assez différentes.

On a constaté depuis longtemps qu'il existe une sorte de compensation entre les hivers dans l'Europe centrale et dans les Etats Unis; si l'hiver est rigoureux en Europe, il est doux et pluvieux aux États Unis et vice versa. En effet, nous constatons ici (diagramme 27), qu'il y a une opposition bien tranchée entre les allures des courbes pour Madrid et S:t-Louis, situés à peu près à la même latitude.

[1] Il serait fort à désirer que les observatoires d'Australie et de Nouvelle Zélande voulussent envoyer leurs publications à titre d'échange aux établissements météorologiques en Europe. Sauf les publications de Sidney et en partie de Brisbane je n'ai presque rien trouvé dans les bibliothèques des Instituts d'Upsala, de Stockholm, de Copenhague, de Hambourg, de Berlin, de Paris et de Bruxelles. Les chiffres de Melbourne et d'Auckland publiées ici sont tirées de SYMONS Meteorological Magazine.

3. *Avril—septembre.* Pendant la saison chaude de l'hémisphère boréale il est plus difficile d'étudier les relations qui nous occupent. D'une part il suffit de regarder les cartes des isobares et des isothermes pour ces mois pour voir immédiatement qu'il n'y a pas de différences si accentuées entre les centres d'action différents qu'en hiver; d'autre part, comme nous l'avons remarqué plus haut, la pluie manque quelquefois tout à fait pendant les mois les plus chauds sur de grands espaces, surtout dans les régions subtropicales. A cause de cela, nous nous bornons à quelques indications.

En première ligne les conditions changées en Sibérie sont les plus remarquables. Le maximum barométrique qui y règne en hiver fait place à un minimum en été. Les diagrammes 14 (Pl. II) font voir une opposition très remarquable entre les courbes pour Barnaul et pour Maurice.

Les diagrammes 15 au contraire pour Thorshavn et pour Ponta Delgada n'offrent plus la même opposition dans les allures des courbes qu'en hiver. L'opposition se présente en effet pendant quelques années, mais ensuite il y a des irrégularités et même des concordances. Cela s'explique par la distribution différentes de la pression pendant les différentes saisons. En hiver le maximum aux Açores et le minimum au sud de l'Islande sont très accentués tous les deux. Au printemps quand le continent de l'Europe commence à s'échauffer la pression de l'air monte au nord-ouest sur la mer, ce qui est la cause bien connue des vents dominants du N. ou du NO. qui amènent les récidives d'hiver en mai et en juin. »*A mi-mai queue d'hiver*», disent les Français, en Allemagne on remarque les »*Kälte-Rückfälle im Mai*», et en Suède on attend les nuits de fer (»*jernnätter*») au printemps. En regardant les magnifiques cartes des isobares de l'Océan Atlantique septentrional, publiées par M. G. Rung à Copenhague, on voit que la haute pression aux Açores envoie une langue ou une bande de haute pression qui s'étend en mai et en juin jusque dans l'Océan glacial arctique. Thorshavn est situé justement au bord de cette bande et par conséquent est situé tantôt dans un régime barométrique, tantôt dans l'autre.

En hiver il y a une concordance assez bonne entre les Açores et la Sibérie occidendale. En comparant les diagrammes 14 et 15, on voit qu'il y a en été plutôt concordance entre Thorshavn et Barnaul.

Enfin dans l'hémisphère austral nous retrouvons (diagr. 16) la même opposition entre Cordoba et Alto da Serra qu'auparavant. Mais une inspection des tableaux suffit pour nous convaincre que d'avril à septembre il n'y a pas de relation entre Maurice et la Nouvelle Zélande.

4. Nous avons émis l'opinion qu'une étude plus suivie de ces relations serait du plus haut intérêt pour la vie pratique et qu'elle promet même de conduire à des résultats importants pour *la prévision du temps à longue échéance.*

Nous finirons la présente étude en indiquant quelques relations curieuses qui à cet égard seront peut-être d'un certain intérêt.

Chaque partie du monde a, comme on sait, sa saison des pluies. Dans l'intérieur des continents et sur leurs côtes orientales dans les zones tempérés, la saison des pluies est l'été, dans les contrés subtropicales c'est l'hiver, et en pleine mer et sur les côtes occidentales, c'est l'automne ou l'hiver. De la planche IV (diagr. 29 et 30) il résulte

visiblement que les saisons des pluies ont souvent une tendance à avoir le même caractère successivement de l'ouest à l'est. Ainsi les diagrammes 29 font voir qu'à 1 ou 2 exceptions près, la *pluie d'hiver* à Thorshavn a la même caractère que la pluie de *l'été précédent* à S:t Johns de Terre Neuve et de *l'été suivant* à Berlin.

Le savant hydrographe, M. O. Pettersson de Stockholm, a démontré recemment[1] qu'il y a une relation intime entre la température du Gulfstream en hiver et le temps de cet hiver et du printemps suivant dans le nordouest de l'Europe.

M. Meinardus de Berlin a étendus ces recherches jusqu'au nord de l'Allemagne. Il a trouvé, entre autres choses, que la température du Gulfstream détermine directement la température de l'air à Christiansund sur la côte de Norvège en automne et en hiver — novembre à janvier —, et que l'écart de la température à Copenhague devient de même sens au printemps suivant, mars—avril. De même le développement des plantes à Eberswalde en Allemagne est plus précoce ou plus rétardé suivant que la température du Gulfstream a été, pendant l'hiver précédent, plus haute ou plus basse qu'en moyenne.[2]

Cependant M. Meinardus remarque avec raison qu'il est ici bien difficile de dire lequel de ces deux phénomènes est la cause de l'autre. On peut aussi bien admettre que c'est l'état de l'atmosphère qui détermine la température du Gulfstream.

En réalité, les hivers doux et pluvieux du nordouest de l'Europe ont pour cause immédiate un développement considérable du minimum barométrique entre l'Islande et la Norvège, ce qui amène un courant d'air continuel du sudouest le long du Gulfstream. Mais il est évident que ces vents augmenteront la vitesse du courant même, et que la température de la surface de la mer doit par conséquent monter. On sait que même les moussons causent des courants de mer assez considérables, changeant leurs directions avec elles. On le voit d'une manière éclatante sur les magnifiques cartes hydrographiques de l'archipel Indo-Néerlandais publiées recemment par M. van der Stok de Batavia.[3]

Quoi qu'il en soit, il est évident que, si le régime des pluies en hiver à Thorshavn détermine la pluie de *l'été suivant* à Berlin, c'est la pluie de *l'été précédent* à Terre Neuve qui à déterminé les pluies d'hiver à Thorshavn. Or, Terre Neuve n'est pas située dans le Gulfstream, mais bien dans le courant froid opposé de Labrador. On pourrait dire pourtant, il est vrai, qu'une augmentation de ce courant serait pour refroidir le Gulfstream au sud de Terre Neuve, refroidissement qui ne se ferait sentir à Thorshavn qu'une demi-année plus tard. De cette manière les variations successives dans le régime des pluies que nous avons constatées seraient encore causées par l'état hydrographique de l'Atlantique nord.

Mais en regardant le diagramme 30, nous constatons *qu'il existe une concordance aussi nette, pendant 15 années consécutives, entre les quantités d'eau tombées en hiver dans*

[1] Om möjligheten af väderleksförutsägelser för längre tid. Mém. de l'Acad. Roy. d'Agriculture de Stockholm, 1896. — Über die Beziehungen zwischen meteorologische und hydrographische Phänomene. Meteor. Zeitschrift 1896. — Om Atlantiska Oceanens inflytande på vårt vinterklimat. Ymer 1898.

[2] Der Zusammenhang des Winterklimas in Mittel- und Nordwest-Europa mit dem Golfstrom. Zeitschrift d. Ges. f. Erdkunde in Berlin. 1898.

[3] Wind and weather, currents, tides and tidal streams in the East-Indian archipelago. Batavia 1897.

la Colombie Britannique au bord de l'Océan Pacifique et celles de l'automne suivant aux Açores. Ici l'influence des courants de mer n'est guère possible.

Il est encore prématuré, selon nous, de chercher *les causes* de ces phénomènes jusqu'ici bien peu étudiés. Ce qui est certain, c'est que l'atmosphère est une masse d'air continue reposant sur les terres et les mers et qu'ils agissent les uns sur les autres. Une perturbation qui survient en un point quelconque doit se faire sentir plus ou moins à des distances très considérables. On aura souvent à chercher la cause d'un certain phénomène dans un autre qui a eu lieu à une place située peut-être dans l'autre hémisphère. Il est possible qu'il est plus qu'une coïncidence accidentelle quand on a remarqué qu'il règne souvent une séchéresse prolongée en Europe aux mêmes années que les glaces flottantes de la mer antarctic sont très abondantes et déscendent jusqu'à la latitude du Cap de Bonne Espérance.

La prévision à longue échéance est peut-être le but pratique principal de la météorologie, et la solution de ce problème sera de la plus grande importance pour le genre humain. Nous avons bien trouvé, il nous semble, quelques traces du chemin qu'on doit suivre pour y arriver. Pour le moment, la solution définitive n'est guère possible en raison du manque d'observations de plusieurs des régions les plus importantes. Ce que nous avons désiré démontrer, c'est *qu'il existe des relations entre les différents centres d'action de l'atmosphère.* Nous ne prétendons pas que nous ayons trouvé ici quelques lois bien arrêtées et des résultats *définitifs.* Ce que nous avons fait, c'est une reconnaissance en une contrée presque inconnue. Cependant, les résultats que nous avons trouvés, encore que provisoires, semblent être d'une importance assez grande pour inviter à une enquête plus détaillée. Mais, comme nous l'avons dit, une telle recherche est possible à la seule condition *que des observatoires aussi complets que possible soient établis au plus tôt dans ces régions importantes.*

	1 Trim.	2 Trim.	3 Trim.	4 Trim.	Oct.— Mars.	Avr.— Sept.	Année.
Adelaide (Australie).							
1882 . . .	18	150	157	74	—	307	399
1883 . . .	35	299	231	114	107	530	679
1884 . . .	91	211	107	69	205	318	478
1885 . . .	38	163	160	41	107	323	402
1886 . . .	28	74	165	99	69	239	366
1887 . . .	38	310	165	140	137	475	653
1888 . . .	15	129	193	33	155	322	370
1889 . . .	102	368	160	155	135	528	785
1890 . . .	79	175	274	124	234	449	652
1891 . . .	30	63	130	132	154	193	355
1892 . . .	66	162	193	127	198	355	548
1893 . . .	15	239	206	86	142	445	546
1894 . . .	58	165	188	117	144	353	528
1895 . . .	76	201	211	51	193	412	539
1896 . . .	58	193	74	58	109	267	383
1897 . . .	76	117	175	20	134	292	388
Alexandria (Égypte).							
1875 . . .	155	0	0	33	—	0	188
1876 . . .	72	3	0	199	105	3	274
1877 . . .	187	1	0	79	386	1	267
1878 . . .	84	0	0	39	163	0	123
1879 . . .	51	1	0	34	90	1	86
1880 . . .	95	3	4	168	129	7	270
1881 . . .	38	4	0	128	206	4	170
1882 . . .	160	23	—	—	288	—	—
1883 . . .	109	0	5	126	—	5	240

	1 Trim.	2 Trim.	3 Trim.	4 Trim.	Oct.— Mars.	Avr.— Sept.	Année.
1884 . . .	231	1	2	69	357	3	303
1885 . . .	122	11	13	86	191	24	232
1886 . . .	28	1	23	38	114	24	90
1887 . . .	138	3	0	41	176	3	182
1888 . . .	114	16	0	151	145	16	281
1889 . . .	106	2	0	147	257	2	255
1890 . . .	80	4	0	150	227	4	234
1891 . . .	123	0	12	48	273	12	183
1892 . . .	81	0	0	133	129	0	214
1893 . . .	146	4	0	118	279	4	268
1894 . . .	91	4	0	122	209	4	217
1895 . . .	2	9	0	103	124	9	114
1896 . . .	87	1	0	80	180	1	168
Alger.							
1875 . . .	363	142	5	287	—	147	797
1876 . . .	278	163	16	411	565	179	868
1877 . . .	182	48	55	500	593	103	785
1878 . . .	308	29	11	269	808	40	617
1879 . . .	228	102	96	271	497	198	697
1880 . . .	248	142	8	146	519	150	544
1881 . . .	273	122	2	307	419	124	704
1882 . . .	229	39	170	399	536	209	837
1883 . . .	272	103	10	466	671	113	851
1884 . . .	201	142	80	406	667	222	829
1885 . . .	169	149	22	192	575	171	532
1886 . . .	316	120	2	500	508	122	938
1887 . . .	399	99	79	361	899	178	938
1888 . . .	354	71	37	335	715	108	797
1889 . . .	434	180	18	347	769	198	979
1890 . . .	359	100	33	445	706	133	937
Alto da Serra (Brésil).							
1873 . . .	1,247	566	640	884	—	1,206	3,337
1874 . . .	993	1,290	650	1,054	1,877	1,940	3,987
1875 . . .	1,377	599	523	1,156	2,431	1,122	3,655
1876 . . .	942	467	378	1,285	2,098	845	3,072
1877 . . .	1,166	780	665	985	2,451	1,445	3,596
1878 . . .	1,062	869	754	1,008	2,047	1,623	3,693
1879 . . .	1,113	452	338	467	2,121	790	2,370
1880 . . .	1,915	693	444	1,024	2,382	1,137	4,076
1881 . . .	1,786	980	711	813	2,810	1,691	4,290
1882 . . .	1,532	996	729	940	2,345	1,725	4,197
1883 . . .	1,372	508	681	963	2,312	1,189	3,524
1884 . . .	1,006	660	924	1,366	1,969	1,584	3,956
1885 . . .	1,024	538	564	775	2,390	1,102	2,901
1886 . . .	1,295	566	754	1,110	2,070	1,320	3,725
1887 . . .	1,171	536	678	1,405	2,281	1,214	3,790
Archangel.							
1874 . . .	62	79	128	92	—	207	361
1875 . . .	58	123	170	57	150	293	408
1876 . . .	63	52	161	68	120	213	344
1877 . . .	52	83	218	75	120	301	428
1878 . . .	51	172	240	133	126	412	596
1879 . . .	30	95	174	69	163	269	368
1880 . . .	50	86	132	131	119	218	399
1881 . . .	103	47	126	48	234	173	324
1882 . . .	94	116	67	46	142	183	323
1883 . . .	51	58	197	53	97	255	359
1884 . . .	46	44	109	43	99	153	242
1885 . . .	49	53	50	89	92	112	241
1886 . . .	24	27	147	70	113	174	268
1887 . . .	43	123	218	97	113	341	481
1888 . . .	38	110	228	84	135	338	460
1889 . . .	33	84	210	59	117	294	386
1890 . . .	48	123	211	115	107	334	497
Auckland (Nouvelle Zélande).							
1882 . . .	300	348	381	124	—	729	1,153
1883 . . .	241	500	279	305	365	779	1,325
1884 . . .	155	244	297	269	460	541	965
1885 . . .	112	185	272	142	381	457	711
1886 . . .	211	208	279	130	353	487	828
1887 . . .	132	345	292	190	262	637	959
1888 . . .	183	274	208	213	373	482	878
1889 . . .	162	429	325	150	375	754	1,066
1890 . . .	91	345	335	399	241	680	1,170
1891 . . .	328	216	244	127	727	460	915
1892 . . .	193	259	328	272	320	587	1,052
1893 . . .	366	320	353	328	638	673	1,367
1894 . . .	195	279	391	178	523	670	1,043
1895 . . .	173	343	343	262	351	686	1,121
1896 . . .	61	358	429	112	323	787	960
Avignon.							
1877 . . .	77	157	122	126	—	279	484
1878 . . .	26	285	106	258	152	391	675
1879 . . .	143	261	196	57	401	457	657
1880 . . .	49	249	181	151	106	430	630
1881 . . .	189	165	169	165	340	334	688
1882 . . .	69	122	210	214	234	332	615

	1 Trim.	2 Trim.	3 Trim.	4 Trim.	Oct.— Mars.	Avr.— Sept.	Année.
1883 . . .	170	200	232	35	384	432	637
1884 . . .	23	240	189	88	58	429	540
1885 . . .	78	286	202	258	166	488	824
1886 . . .	113	116	116	388	371	232	733
1887 . . .	127	117	212	274	515	329	730
1888 . . .	94	239	264	326	368	503	923
1889 . . .	170	224	50	110	496	274	554
1890 . . .	147	181	74	153	257	255	555
1891 . . .	50	176	135	341	203	311	702
1892 . . .	187	72	188	195	528	260	642
Barnaul (Sibérie).							
1874 . . .	20	30	80	96	—	110	226
1875 . . .	40	127	53	106	136	180	326
1876 . . .	33	142	105	90	139	247	370
1877 . . .	49	76	105	24	139	181	254
1878 . . .	20	98	119	103	44	217	340
1879 . . .	30	96	146	131	133	242	403
1880 . . .	54	128	126	71	185	254	379
1881 . . .	33	44	154	109	104	198	340
1882 . . .	33	102	178	126	142	280	439
1883 . . .	105	98	173	67	231	271	443
1884 . . .	120	111	86	42	187	197	369
1885 . . .	61	114	87	111	103	201	373
1886 . . .	57	130	168	85	168	298	440
1887 . . .	61	159	174	190	146	333	583
1888 . . .	119	148	167	150	309	715	584
1889 . . .	55	164	196	110	205	360	525
1890 . . .	66	36	94	136	176	130	332
1891 . . .	78	184	98	179	214	282	539
1892 . . .	58	157	139	112	237	296	466
1893 . . .	32	89	85	128	144	174	334
1894 . . .	66	159	172	117	194	331	514
1895 . . .	95	202	88	83	212	290	468
1896 . . .	59	99	200	120	142	299	478
Beirut.							
1876 . . .	184	118	3	448	—	121	753
1877 . . .	694	68	12	533	1,142	80	1,307
1878 . . .	564	125	21	136	1,097	146	846
1879 . . .	309	34	3	542	445	37	888
1880 . . .	432	66	36	286	974	102	820
1881 . . .	418	29	19	322	704	98	838
1882 . . .	409	226	0	314	731	226	949
1883 . . .	637	19	7	607	951	26	1,270
1884 . . .	521	56	27	166	1,128	83	770
1885 . . .	410	98	18	278	576	116	804
1886 . . .	609	24	13	393	887	37	939
1887 . . .	333	18	3	336	626	21	690
1888 . . .	392	207	1	398	728	208	998
1889 . . .	315	31	0	245	713	31	591
1890 . . .	331	42	5	653	576	47	1,031
1891 . . .	458	58	61	315	1,111	119	892
1892 . . .	414	104	0	380	729	104	898
1893 . . .	737	47	1	389	1,117	48	1,174
1894 . . .	415	124	0	445	804	124	984
1895 . . .	163	94	4	392	608	98	653
1896 . . .	533	68	8	483	925	76	1,092
Bergen (Norvège).							
1875 . . .	290	356	392	400	—	748	1,438
1876 . . .	323	238	523	196	723	761	1,280
1877 . . .	412	266	430	612	608	696	1,720
1878 . . .	499	259	379	298	1,111	638	1,435
1879 . . .	130	204	488	659	428	692	1,481
1880 . . .	466	296	453	508	1,125	749	1,723
1881 . . .	257	316	538	618	765	854	1,729
1882 . . .	928	283	562	222	1,546	845	1,995
1883 . . .	356	369	414	738	578	783	1,877
1884 . . .	565	290	440	738	1,303	730	2,033
1885 . . .	567	346	543	888	1,305	889	2,344
1886 . . .	328	381	979	597	1,216	1,360	2,285
1887 . . .	522	461	945	905	1,119	1,406	2,833
1888 . . .	398	397	484	848	1,303	881	2,127
1889 . . .	547	183	422	590	1,395	605	1,742
1890 . . .	488	258	836	693	1,078	1,094	2,275
Berlin.							
1874 . . .	118	122	98	92	—	220	360
1875 . . .	138	158	102	232	230	260	630
1876 . . .	240	108	149	141	472	257	638
1877 . . .	226	88	216	98	367	304	628
1878 . . .	155	152	170	80	253	322	557
1879 . . .	191	113	147	122	271	260	573
1880 . . .	64	140	162	223	186	302	589
1881 . . .	132	98	168	117	355	266	515
1882 . . .	100	174	330	159	217	504	763
1883 . . .	45	80	181	185	204	261	491
1884 . . .	104	130	156	216	299	286	606
1885 . . .	86	163	189	135	302	352	573
1886 . . .	79	141	91	118	214	222	429
1887 . . .	58	200	132	111	176	332	501

	1 Trim.	2 Trim.	3 Trim.	4 Trim.	Oct.— Mars.	Avr.— Sept.	Année.
1888 . . .	204	81	152	174	315	233	611
1889 . . .	127	103	214	123	301	317	567
1890 . . .	87	165	131	138	210	296	521
Berufjord (Islande).							
1874 . . .	227	170	263	294	—	397	954
1875 . . .	421	241	271	438	715	512	1,371
1876 . . .	278	225	146	307	716	371	956
1877 . . .	236	(168)	128	404	543	(296)	936
1878 . . .	208	289	300	210	612	589	1,007
1879 . . .	240	275	212	260	450	487	987
1880 . . .	377	130	216	217	637	346	940
1881 . . .	220	183	138	565	437	321	1,106
1882 . . .	564	246	275	476	1,129	521	1,561
1883 . . .	461	286	319	393	937	605	1,459
1884 . . .	514	341	523	362	907	864	1,740
1885 . . .	267	225	330	299	629	555	1,121
1886 . . .	228	148	355	364	527	503	1,095
1887 . . .	341	107	82	42	705	189	572
1888 . . .	240	96	172	511	282	268	1,019
1889 . . .	164	469	263	766	675	732	1,662
1890 . . .	479	217	290	465	1,245	507	1,451
1891 . . .	272	157	331	538	737	488	1,298
1892 . . .	151	163	213	287	689	376	815
1893 . . .	218	254	285	232	545	539	989
Bregrenz.							
1875 . . .	262	444	370	429	—	814	1,505
1876 . . .	434	545	439	262	863	984	1,680
1877 . . .	505	454	572	343	767	1,026	1,874
1878 . . .	388	598	520	296	731	1,118	1,802
1879 . . .	236	474	545	266	532	1,019	1,521
1880 . . .	128	462	527	399	394	989	1,516
1881 . . .	198	451	643	134	597	1,094	1,426
1882 . . .	112	411	675	390	246	1,086	1,588
1883 . . .	183	481	544	341	573	1,025	1,549
1884 . . .	208	386	479	281	549	865	1,354
1885 . . .	185	366	548	369	466	914	1,468
1886 . . .	209	569	491	248	578	1,060	1,517
1887 . . .	151	353	386	357	399	739	1,247
1888 . . .	318	493	807	270	675	1,300	1,888
1889 . . .	268	607	549	312	538	1,156	1,736
1890 . . .	175	513	733	260	487	1,246	1,681
Cape Town.							
1875 . . .	53	224	231	145	—	455	653
1876 . . .	61	198	290	130	206	488	679
1877 . . .	74	503	165	163	204	668	905
1878 . . .	91	432	391	127	254	823	1,041
1879 . . .	48	160	178	89	175	338	475
1880 . . .	86	117	213	33	175	330	449
1881 . . .	38	348	193	71	71	541	650
1882 . . .	119	206	252	168	190	458	477
1883 . . .	69	335	328	84	237	663	816
1884 . . .	48	239	277	158	132	516	722
1885 . . .	94	299	198	117	252	497	708
1886 . . .	91	272	224	119	208	496	706
1887 . . .	51	226	198	112	170	424	587
1888 . . .	25	556	241	91	137	797	913
1889 . . .	71	353	297	66	162	650	787
1890 . . .	48	224	307	89	114	531	668
1891 . . .	41	351	345	33	130	696	770
1892 . . .	71	450	366	155	104	816	1,042
1893 . . .	15	231	292	58	170	523	596
1894 . . .	56	218	198	99	114	416	571
Christiansund (Norvège).							
1875 . . .	74	129	239	257	—	368	699
1876 . . .	170	163	253	212	427	416	798
1877 . . .	157	143	201	365	363	344	866
1878 . . .	407	150	320	283	772	470	1,160
1879 . . .	188	131	174	501	471	305	994
1880 . . .	272	170	286	541	773	456	1,269
1881 . . .	218	194	375	287	759	569	1,074
1882 . . .	451	184	173	127	738	357	935
1883 . . .	199	171	211	499	326	382	1,080
1884 . . .	291	247	266	480	790	513	1,284
1885 . . .	163	156	266	517	643	422	1,102
1886 . . .	81	174	360	196	598	534	811
1887 . . .	502	276	327	439	698	603	1,544
1888 . . .	200	132	260	477	639	392	1,069
1889 . . .	462	86	164	267	937	250	979
1890 . . .	315	148	419	313	582	567	1,195
Colombie Britannique.							
1878 . . .	269	141	105	279	—	246	794
1879 . . .	411	147	184	374	690	331	1,116
1880 . . .	337	125	122	286	711	247	870
1881 . . .	277	194	137	328	563	331	936
1882 . . .	194	107	108	210	522	215	619
1883 . . .	128	75	38	189	338	113	430
1884 . . .	114	68	110	113	303	178	405

	1 Trim.	2 Trim.	3 Trim.	4 Trim.	Oct.— Mars.	Avr.— Sept.	Année.
1885 . . .	218	68	85	171	331	153	542
1886 . . .	213	103	152	466	384	255	934
1887 . . .	438	201	166	502	504	367	1,307
1888 . . .	397	273	131	449	899	404	1,250
1889 . . .	261	169	191	302	710	360	923
1890 . . .	275	229	187	485	577	416	1,176
Copenhague.							
1875 . . .	108	108	143	122	—	251	481
1876 . . .	152	118	117	102	274	233	489
1877 . . .	156	85	239	127	258	324	607
1878 . . .	112	127	122	169	239	249	530
1879 . . .	102	146	213	59	271	359	520
1880 . . .	60	95	146	266	119	241	567
1881 . . .	78	65	213	134	344	278	490
1882 . . .	73	128	165	132	207	293	498
1883 . . .	47	77	187	184	179	264	495
1884 . . .	157	62	159	176	341	221	554
1885 . . .	83	112	159	111	259	271	465
1886 . . .	71	82	113	134	182	195	400
1887 . . .	50	108	120	113	184	228	321
1888 . . .	138	97	157	117	251	254	509
1889 . . .	71	93	223	72	188	316	459
1890 . . .	67	95	178	80	139	273	420
Cordoba (Rép. Argentina).							
1875 . . .	202	22	110	242	—	132	576
1876 . . .	387	92	47	422	629	139	948
1877 . . .	276	43	7	219	698	50	545
1878 . . .	584	83	13	309	803	96	989
1879 . . .	303	98	6	210	612	104	617
1880 . . .	215	25	87	369	425	112	696
1881 . . .	191	80	13	337	560	93	621
1882 . . .	226	24	4	229	563	28	483
1883 . . .	221	20	18	497	450	38	756
1884 . . .	332	42	20	285	829	62	679
1885 . . .	434	15	72	172	719	87	693
1886 . . .	220	65	34	181	392	99	500
1887 . . .	169	79	10	270	350	89	528
1888 . . .	224	69	10	313	494	79	616
1889 . . .	628	85	14	278	941	99	1,005
1890 . . .	321	41	40	274	599	81	676
1891 . . .	196	49	89	466	470	138	800
1892 . . .	291	45	52	383	751	97	771
1893 . . .	286	142	22	260	669	164	710

	1 Trim.	2 Trim.	3 Trim.	4 Trim.	Oct.— Mars.	Avr.— Sept.	Année.
Ènisseisk (Sibérie).							
1874 . . .	60	76	181	96	—	257	413
1875 . . .	67	62	169	73	163	231	371
1876 . . .	41	136	104	70	114	240	351
1877 . . .	34	92	184	56	104	276	366
1878 . . .	34	139	117	84	90	256	374
1879 . . .	37	137	197	100	121	334	471
1880 . . .	44	98	158	112	144	256	412
1881 . . .	70	134	166	67	182	300	437
1882 . . .	53	31	196	45	120	227	325
1883 . . .	47	106	184	79	92	290	416
1884 . . .	18	79	224	73	97	303	394
1885 . . .	38	118	222	130	111	340	508
1886 . . .	84	122	126	98	214	248	430
1887 . . .	61	104	153	176	159	257	494
1888 . . .	53	101	162	107	229	263	423
1889 . . .	39	114	127	95	136	241	375
1890 . . .	44	145	118	106	139	263	413
1891 . . .	52	157	207	113	158	364	529
1892 . . .	33	117	165	77	146	282	392
1893 . . .	34	141	172	111	111	313	458
1894 . . .	72	122	134	92	183	256	420
1895 . . .	55	148	133	101	147	281	437
1896 . . .	29	53	210	133	130	263	425
Fanö (Danemarc).							
1875 . . .	111	128	112	143	—	240	494
1876 . . .	130	99	194	161	273	293	584
1877 . . .	177	100	260	271	338	360	808
1878 . . .	137	102	202	290	408	304	731
1879 . . .	82	184	332	124	372	516	722
1880 . . .	77	115	256	286	201	371	734
1881 . . .	84	89	234	167	370	323	574
1882 . . .	106	183	242	314	273	425	845
1883 . . .	95	50	272	244	409	322	661
1884 . . .	152	60	266	233	396	326	711
1885 . . .	100	75	197	246	333	272	618
1886 . . .	112	116	168	247	358	284	643
1887 . . .	46	68	179	180	293	247	473
1888 . . .	103	154	140	167	283	294	564
1889 . . .	97	62	245	152	264	307	556
1890 . . .	95	126	244	188	247	370	653
Greenwich.							
1875 . . .	112	135	259	206	—	394	712
1876 . . .	124	89	135	264	330	224	612

	1 Trim.	2 Trim.	3 Trim.	4 Trim.	Oct.— Mars.	Avr.— Sept.	Année.
1877 . . .	211	137	165	180	475	302	693
1878 . . .	76	335	165	160	256	500	736
1879 . . .	178	259	300	58	338	559	795
1880 . . .	81	127	223	323	139	350	754
1881 . . .	150	104	208	190	473	312	652
1882 . . .	91	155	152	239	281	307	637
1883 . . .	137	119	165	135	376	284	556
1884 . . .	117	109	114	117	252	223	457
1885 . . .	132	147	140	188	249	287	607
1886 . . .	137	150	124	203	325	274	614
1887 . . .	76	119	147	160	279	266	502
1888 . . .	117	140	284	157	277	424	698
1889 . . .	112	183	142	155	269	325	592
1890 . . .	129	142	196	86	284	338	553
Halmstad (Suède).							
1875 . . .	143	179	170	151	—	349	693
1876 . . .	136	112	230	132	287	342	610
1877 . . .	209	135	367	219	341	502	930
1878 . . .	141	142	184	199	360	326	666
1879 . . .	106	164	352	116	305	516	738
1880 . . .	110	119	190	270	226	309	689
1881 . . .	91	99	323	196	361	422	709
1882 . . .	191	182	321	188	387	503	882
1883 . . .	94	119	319	291	282	438	823
1884 . . .	210	136	264	206	501	400	816
1885 . . .	154	109	194	208	360	303	665
1886 . . .	91	120	126	135	299	246	472
1887 . . .	39	112	212	155	174	324	518
1888 . . .	166	174	292	233	321	466	865
1889 . . .	167	80	430	94	400	480	741
1890 . . .	144	178	295	179	238	473	796
Haparanda.							
1874 . . .	30	97	135	139	—	232	401
1875 . . .	38	55	60	81	177	115	234
1876 . . .	130	94	181	89	211	275	494
1877 . . .	101	126	120	211	190	246	558
1878 . . .	69	139	135	188	280	274	521
1879 . . .	100	92	214	112	288	306	518
1880 . . .	91	74	111	69	203	185	345
1881 . . .	35	74	208	136	114	282	453
1882 . . .	102	137	107	55	238	244	401
1883 . . .	72	85	97	202	124	182	456
1884 . . .	134	99	68	111	336	167	412
1885 . . .	113	149	79	205	224	228	546
1886 . . .	96	155	186	164	301	291	551
1887 . . .	78	59	212	145	242	271	494
1888 . . .	87	92	212	178	232	304	569
1889 . . .	146	57	152	146	324	209	501
1890 . . .	147	92	242	132	293	334	613
Honolulu.							
1874 . . .	447	125	152	622	—	277	1,346
1875 . . .	288	275	131	298	910	406	992
1876 . . .	378	267	115	168	676	382	928
1877 . . .	119	187	57	122	287	244	485
1878 . . .	15	95	63	120	137	158	293
1879 . . .	315	135	105	363	435	240	918
1880 . . .	272	69	200	287	635	269	828
1881 . . .	255	162	136	399	542	298	952
1882 . . .	355	85	79	217	754	164	736
1883 . . .	280	55	90	236	497	145	661
1884 . . .	174	89	77	224	410	166	564
1885 . . .	106	493	236	163	330	729	998
1886 . . .	103	80	147	370	266	227	700
1887 . . .	391	255	78	592	761	333	1,316
1888 . . .	465	133	204	169	1,057	337	971
Iviktut (Groenlande).							
1875 . . .	177	163	445	383	—	608	1,168
1876 . . .	131	316	129	234	514	445	810
1877 . . .	272	(86)	246	163	508	332	(767)
1878 . . .	384	159	388	733	547	548	1,664
1879 . . .	215	467	245	916	948	712	1,843
1880 . . .	232	410	497	387	1,148	907	1,526
1881 . . .	104	106	201	119	491	308	530
1882 . . .	110	138	264	(124)	229	402	(636)
1883 . . .	347	298	354	320	471	652	1,319
1884 . . .	103	417	184	312	423	601	1,016
1885 . . .	245	189	243	225	557	432	902
1886 . . .	272	332	305	427	497	637	1,336
1887 . . .	68	337	298	934	495	634	1,637
1888 . . .	554	389	336	450	1,488	725	1,729
1889 . . .	511	407	406	209	961	813	1,533
1890 . . .	144	161	405	275	353	566	985
1891 . . .	766	294	360	235	1,041	654	1,655
Kalmar (Suède).							
1874 . . .	35	37	90	113	—	127	275
1875 . . .	93	82	114	111	206	196	400
1876 . . .	61	113	123	70	172	236	367

	1 Trim.	2 Trim.	3 Trim.	4 Trim.	Oct.— Mars.	Avr.— Sept.	Année.
1877 . . .	74	56	138	50	144	194	318
1878 . . .	20	90	105	68	74	195	287
1879 . . .	60	77	158	51	128	235	346
1880 . . .	25	67	139	183	76	206	414
1881 . . .	90	62	203	98	273	265	453
1882 . . .	41	83	162	131	139	245	417
1883 . . .	65	163	230	152	196	393	610
1884 . . .	110	119	85	100	262	204	414
1885 . . .	65	67	187	88	165	254	407
1886 . . .	81	65	65	88	169	130	299
1887 . . .	45	184	112	181	133	236	462
1888 . . .	70	30	123	75	251	190	338
1889 . . .	80	81	250	67	155	331	478
1890 . . .	35	188	154	149	102	342	526
Kasan.							
1875 . . .	32	172	206	92	—	378	502
1876 . . .	34	151	190	95	126	341	470
1877 . . .	52	81	234	18	147	315	385
1878 . . .	69	136	211	68	87	347	484
1879 . . .	36	133	166	64	104	299	399
1880 . . .	35	155	112	79	99	267	381
1881 . . .	32	107	162	56	111	269	357
1882 . . .	36	125	53	134	92	178	348
1883 . . .	70	89	110	80	204	199	349
1884 . . .	29	125	130	63	109	255	347
1885 . . .	75	141	212	90	138	353	518
1886 . . .	17	147	140	54	107	287	358
1887 . . .	36	90	214	114	90	304	454
1888 . . .	51	126	211	101	165	337	489
1889 . . .	52	134	119	74	153	253	379
1890 . . .	54	120	114	105	128	234	393
Key West (Florida).							
1874 . . .	119	226	361	125	—	587	831
1875 . . .	46	198	559	119	171	757	922
1876 . . .	66	252	330	318	185	582	966
1877 . . .	119	226	323	302	437	549	970
1878 . . .	330	224	500	193	632	724	1,247
1879 . . .	201	330	427	531	394	757	1,489
1880 . . .	64	254	394	140	595	648	852
1881 . . .	114	419	599	218	254	1,018	1,350
1882 . . .	43	379	396	246	261	775	1,064
1883 . . .	114	239	325	549	360	564	1,227
1884 . . .	94	150	320	277	643	470	841
1885 . . .	239	165	277	183	516	442	864
1886 . . .	73	117	467	109	256	584	766
1887 . . .	94	292	381	343	203	673	1,110
1888 . . .	46	119	419	320	389	538	904
1889 . . .	264	221	630	224	584	851	1,339
Kiev.							
1875 . . .	81	165	180	190	—	345	616
1876 . . .	89	155	156	152	279	311	552
1877 . . .	121	179	207	102	273	386	609
1878 . . .	100	153	67	174	202	220	494
1879 . . .	191	115	260	180	365	375	746
1880 . . .	50	165	186	84	235	351	485
1881 . . .	80	107	126	126	164	233	439
1882 . . .	66	159	175	143	192	334	543
1883 . . .	80	227	105	97	223	332	509
1884 . . .	97	164	201	188	194	365	650
1885 . . .	74	164	267	150	262	431	655
1886 . . .	119	127	214	178	269	341	638
1887 . . .	87	154	170	215	265	324	626
1888 . . .	111	117	195	119	326	312	542
1889 . . .	139	217	218	139	258	435	713
1890 . . .	60	126	156	105	199	282	447
Kyleakin (Phâre, Écosse).							
1874 . . .	706	533	731	747	—	1,264	2,717
1875 . . .	416	335	411	462	1,163	746	1,624
1876 . . .	663	389	406	396	1,125	795	1,854
1877 . . .	744	447	358	1,013	1,140	805	2,562
1878 . . .	416	320	394	460	1,429	714	1,590
1879 . . .	272	170	427	366	732	597	1,235
1880 . . .	516	195	241	358	882	436	1,310
1881 . . .	211	234	338	625	569	572	1,408
1882 . . .	643	307	340	495	1,268	647	1,785
1883 . . .	462	157	274	645	957	431	1,538
1884 . . .	587	208	302	736	1,232	510	1,833
1885 . . .	424	259	368	597	1,160	627	1,648
1886 . . .	335	262	409	587	932	671	1,593
1887 . . .	612	218	424	498	1,199	642	1,752
1888 . . .	289	272	328	551	787	600	1,440
1889 . . .	495	168	325	488	1,046	493	1,476
1890 . . .	569	201	378	447	1,057	579	1,595
Libau.							
1874 . . .	95	84	235	195	—	329	609
1875 . . .	134	139	127	89	329	266	489
1876 . . .	88	51	268	158	177	318	565

	1 Trim.	2 Trim.	3 Trim.	4 Trim.	Oct.— Mars.	Avr.— Sept.	Année.
1877 . . .	122	63	230	149	280	293	564
1878 . . .	105	176	122	234	254	298	637
1879 . . .	132	79	263	170	366	342	644
1880 . . .	61	124	198	329	231	322	712
1881 . . .	76	61	205	106	405	266	448
1882 . . .	88	83	177	144	194	260	492
1883 . . .	57	118	202	259	201	320	636
1884 . . .	109	113	150	258	368	263	630
1885 . . .	71	78	284	210	329	362	643
1886 . . .	90	130	152	134	300	282	506
1887 . . .	52	139	167	230	186	306	588
1888 . . .	91	123	225	195	321	348	534
1889 . . .	125	76	345	105	320	421	651
1890 . . .	93	94	228	159	198	322	574
Madrid.							
1875 . . .	88	63	47	86	—	114	284
1876 . . .	75	76	16	225	161	92	392
1877 . . .	77	111	145	98	302	256	431
1878 . . .	36	89	14	194	134	103	333
1879 . . .	115	60	32	185	309	92	392
1880 . . .	89	161	63	144	274	294	457
1881 . . .	262	123	24	50	406	147	459
1882 . . .	41	100	85	124	91	185	350
1883 . . .	150	143	8	122	274	151	423
1884 . . .	71	226	112	108	193	338	517
1885 . . .	265	123	161	148	364	284	697
1886 . . .	155	204	75	170	303	279	604
1887 . . .	69	91	68	227	239	159	455
1888 . . .	163	180	107	171	390	287	621
1889 . . .	124	189	6	53	295	195	372
1890 . . .	80	141	86	76	133	227	383
1891 . . .	79	74	71	150	155	145	374
1892 . . .	221	116	22	104	371	138	463
1893 . . .	102	178	109	126	206	287	515
1894 . . .	81	174	87	130	207	261	472
Maurice.							
1875 . . .	206	536	147	381	—	683	1,270
1876 . . .	597	234	94	140	978	328	1,065
1877 . . .	889	399	130	396	1,029	529	1,814
1878 . . .	318	333	216	231	714	549	1,098
1879 . . .	579	267	175	226	810	442	1,247
1880 . . .	384	150	137	196	610	287	867
1881 . . .	269	399	183	302	465	582	1,153
1882 . . .	953	132	175	165	1,255	307	1,425
1883 . . .	427	518	79	185	592	597	1,209
1884 . . .	412	506	79	168	597	585	1,165
1885 . . .	371	335	216	211	539	551	1,133
1886 . . .	259	145	97	257	470	242	758
1887 . . .	660	236	125	165	917	361	1,186
1888 . . .	699	114	137	394	864	251	1,344
1889 . . .	897	196	188	145	1,291	384	1,426
1890 . . .	696	320	178	158	841	498	1,352
1891 . . .	513	292	163	165	671	455	1,133
1892 . . .	772	279	211	241	937	490	1,503
1893 . . .	536	424	160	107	777	584	1,227
1894 . . .	587	287	160	211	694	447	1,245
1895 . . .	742	218	168	249	953	386	1,377
1896 . . .	1,080	457	130	66	1,329	587	1,733
Melbourne.							
1882 . . .	38	158	142	229	—	300	567
1883 . . .	155	125	130	193	384	255	603
1884 . . .	249	97	79	234	442	176	659
1885 . . .	150	188	168	180	384	356	686
1886 . . .	198	66	117	231	378	183	612
1887 . . .	117	252	163	295	348	415	827
1888 . . .	132	147	97	119	427	244	459
1889 . . .	152	185	132	221	271	317	690
1890 . . .	91	150	165	211	312	315	617
1891 . . .	71	183	244	180	282	427	678
1892 . . .	76	216	147	196	256	363	635
1893 . . .	48	236	185	213	244	421	682
1894 . . .	43	170	175	185	256	345	573
1895 . . .	112	109	140	76	297	249	437
1896 . . .	211	203	170	69	287	373	653
1897 . . .	252	109	175	122	321	284	658
Milan.							
1875 . . .	95	282	408	160	—	690	945
1876 . . .	204	523	74	196	364	597	997
1877 . . .	188	274	152	238	384	326	852
1878 . . .	86	319	261	331	324	580	997
1879 . . .	237	394	222	142	568	616	995
1880 . . .	110	326	360	212	252	686	1,008
1881 . . .	187	370	243	294	399	613	1,094
1882 . . .	105	184	491	489	449	675	1,269
1883 . . .	251	288	192	138	740	480	869
1884 . . .	45	283	390	80	183	673	798
1885 . . .	267	252	358	293	347	610	1,170
1886 . . .	248	217	216	536	541	433	1,217

	1 Trim.	2 Trim.	3 Trim.	4 Trim.	Oct.— Mars.	Avr.— Sept.	Année.
1887 . . .	151	271	117	460	687	388	999
1888 . . .	274	389	207	289	731	596	1,159
1889 . . .	181	394	199	405	470	593	1,179
1890 . . .	231	325	318	159	636	643	1,033
Montpellier (École d'Agriculture).							
1875 . . .	96	269	475	231	—	744	1,071
1876 . . .	377	212	189	367	608	401	1,145
1877 . . .	125	263	105	126	492	368	619
1878 . . .	18	293	70	247	144	363	628
1879 . . .	338	195	134	119	685	329	786
1880 . . .	88	308	148	152	207	456	696
1881 . . .	402	81	27	182	554	108	692
1882 . . .	416	90	141	141	298	231	488
1883 . . .	214	303	107	50	355	410	674
1884 . . .	125	231	88	186	175	319	630
1885 . . .	130	201	47	332	316	448	910
1886 . . .	67	50	39	57	399	89	213
1887 . . .	287	119	152	158	344	271	716
1888 . . .	310	169	157	433	468	326	1,069
1889 . . .	140	248	22	115	573	270	525
1890 . . .	323	178	133	246	438	311	880
Montrose (Écosse).							
1874 . . .	76	94	391	195	—	485	756
1875 . . .	203	130	264	267	398	394	864
1876 . . .	168	140	142	381	435	282	831
1877 . . .	248	211	404	254	629	615	1,117
1878 . . .	84	193	221	188	338	414	686
1879 . . .	140	218	414	107	328	632	879
1880 . . .	170	104	206	162	277	310	642
1881 . . .	71	109	218	221	233	327	619
1882 . . .	86	241	229	350	307	470	906
1883 . . .	277	124	300	107	627	424	808
1884 . . .	180	107	201	130	287	308	618
1885 . . .	119	150	121	127	249	271	517
1886 . . .	183	140	198	203	310	338	724
1887 . . .	99	86	160	147	302	246	492
1888 . . .	165	132	193	216	312	325	706
1889 . . .	114	127	145	124	330	272	510
1890 . . .	152	150	203	206	276	353	711
New York.							
1874 . . .	231	306	329	171	—	635	1,037
1875 . . .	260	161	461	263	431	622	1,145
1876 . . .	368	269	354	213	631	623	1,204
1877 . . .	301	183	196	359	514	379	1,039
1878 . . .	304	218	400	264	663	618	1,186
1879 . . .	199	247	254	218	463	501	918
1880 . . .	228	145	339	238	446	484	950
1881 . . .	438	243	108	237	676	351	1,026
1882 . . .	326	233	480	145	563	713	1,184
1883 . . .	239	276	234	237	384	510	1,286
1884 . . .	396	284	377	349	633	661	1,406
1885 . . .	274	166	291	339	623	457	1,070
1886 . . .	367	368	141	311	706	509	1,187
1887 . . .	329	314	323	218	640	637	1,184
1888 . . .	376	257	382	330	594	639	1,345
1889 . . .	318	293	519	360	648	812	1,490
Ponta Delgada (Açores).							
1874 . . .	283	130	90	303	—	220	806
1875 . . .	463	146	202	284	766	348	1,095
1876 . . .	236	61	219	524	520	280	1,040
1877 . . .	195	290	133	313	719	423	931
1878 . . .	204	250	154	309	517	404	917
1879 . . .	181	126	73	647	490	199	1,027
1880 . . .	291	152	181	482	938	333	1,106
1881 . . .	528	150	153	255	1,010	303	1,086
1882 . . .	208	91	59	250	463	150	608
1883 . . .	369	207	142	175	619	349	893
1884 . . .	323	188	166	191	498	354	868
1885 . . .	245	151	75	276	436	226	747
1886 . . .	241	204	193	296	517	397	934
1887 . . .	387	231	88	590	583	319	1,296
1888 . . .	411	166	193	280	1,001	359	1,050
1889 . . .	179	197	125	108	459	322	609
1890 . . .	165	52	70	146	273	122	433
1891 . . .	262	189	146	218	408	335	815
1892 . . .	233	211	97	328	451	308	869
1893 . . .	187	308	128	282	511	436	1,025
1894 . . .	239	140	111	242	521	251	732
1895 . . .	299	208	172	393	541	380	1,022
1896 . . .	257	195	42	221	650	237	715
1897 . . .	189	144	74	249	410	218	656
Riva.							
1875 . . .	69	279	250	256	—	529	854
1876 . . .	235	620	231	291	491	851	1,377
1877 . . .	229	396	303	238	520	699	1,166
1878 . . .	92	272	422	495	330	694	1,281

	1 Trim.	2 Trim.	3 Trim.	4 Trim.	Oct.— Mars.	Avr.— Sept.	Année.
1879 . . .	265	530	288	215	760	818	1,298
1880 . . .	99	267	338	469	314	605	1,173
1881 . . .	156	251	183	269	625	534	959
1882 . . .	112	268	507	456	381	775	1,343
1883 . . .	169	259	388	189	625	647	1,005
1884 . . .	28	370	232	113	217	602	743
1885 . . .	244	350	371	283	357	721	1,248
1886 . . .	222	256	274	681	505	530	1,433
1887 . . .	163	233	236	458	844	469	1,090
1888 . . .	434	348	493	223	892	841	1,498
1889 . . .	129	312	383	414	352	695	1,238
1890 . . .	141	360	394	111	555	754	1,006
S:t Johns (Terre Neuve).							
1878 . . .	281	319	212	381	—	531	1,193
1879 . . .	308	327	254	307	689	581	1,196
1880 . . .	385	291	201	226	692	492	1,103
1881 . . .	276	319	421	343	502	740	1,359
1882 . . .	431	311	381	395	774	692	1,518
1883 . . .	191	169	305	464	586	474	1,129
1884 . . .	398	326	295	524	862	621	1,543
1885 . . .	440	374	215	454	964	589	1,483
1886 . . .	393	260	248	281	847	508	1,182
1887 . . .	421	248	295	344	702	543	1,308
1888 . . .	367	284	182	594	711	466	1,427
1889 . . .	337	220	172	356	931	392	1,085
1890 . . .	310	319	340	425	666	659	1,394
Saint Louis (États Unis).							
1874 . . .	285	231	323	125	—	554	964
1875 . . .	183	480	315	114	308	795	1,092
1876 . . .	368	300	452	91	482	752	1,211
1877 . . .	140	373	231	305	231	604	1,049
1878 . . .	170	351	307	206	475	658	1,034
1879 . . .	127	185	140	198	333	325	650
1880 . . .	229	234	249	188	427	483	880
1881 . . .	168	249	142	391	336	391	950
1882 . . .	386	323	198	191	777	521	1,098
1883 . . .	231	285	196	307	422	481	1,019
1884 . . .	208	290	257	279	515	547	1,034
1885 . . .	114	389	368	285	393	757	1,156
1886 . . .	201	432	320	175	486	752	1,128
1887 . . .	201	310	163	226	376	473	900
1888 . . .	211	351	257	229	437	608	1,048
1889 . . .	239	259	163	180	468	422	841

	1 Trim.	2 Trim.	3 Trim.	4 Trim.	Oct.— Mars.	Avr.— Sept.	Année.
San Diego (États Unis).							
1874 . . .	203	18	5	51	—	23	277
1875 . . .	81	8	15	69	132	23	173
1876 . . .	170	5	3	8	239	8	186
1877 . . .	69	18	0	122	77	18	209
1878 . . .	196	94	0	64	318	94	354
1879 . . .	119	18	0	239	183	18	376
1880 . . .	89	38	10	127	328	48	264
1881 . . .	74	36	3	18	201	39	131
1882 . . .	206	18	0	23	224	18	247
1883 . . .	64	38	0	102	87	38	204
1884 . . .	422	135	3	142	524	138	702
1885 . . .	31	48	3	66	173	51	148
1886 . . .	310	53	0	28	376	53	391
1887 . . .	117	69	0	81	145	69	267
1888 . . .	158	10	3	125	239	13	296
1889 . . .	145	8	0	254	270	8	407
San Fernando (Éspagne).							
1874 . . .	194	94	77	284	—	171	649
1875 . . .	219	78	0	366	503	78	663
1876 . . .	108	69	9	443	474	78	629
1877 . . .	165	90	129	58	608	219	442
1878 . . .	87	28	10	321	145	38	446
1879 . . .	322	55	20	437	643	84	843
1880 . . .	155	194	3	240	592	197	592
1881 . . .	607	309	28	238	847	337	1,182
1882 . . .	92	118	4	176	330	122	390
1883 . . .	413	259	1	223	589	260	896
1884 . . .	226	158	24	184	449	182	592
1885 . . .	246	83	50	325	430	133	704
1886 . . .	150	65	21	246	475	86	482
1887 . . .	221	102	3	308	467	105	634
1888 . . .	264	210	30	385	562	240	893
1889 . . .	181	79	91	68	570	170	419
1890 . . .	248	162	7	334	316	169	751
1891 . . .	237	35	112	363	571	147	687
1892 . . .	393	157	7	311	696	164	868
1893 . . .	209	94	63	155	520	157	511
1894 . . .	214	81	0	329	363	81	624
1895 . . .	459	121	27	351	788	148	958
Sapporo (Japon).							
1877 . . .	288	202	265	399	—	467	1,154
1878 . . .	279	183	349	248	678	532	1,059
1879 . . .	365	155	134	449	613	589	1,403

	1 Trim.	2 Trim.	3 Trim.	4 Trim.	Oct.— Mars.	Avr.— Sept.	Année.
1880 . . .	248	135	210	343	697	345	936
1881 . . .	329	125	234	328	672	359	1,016
1882 . . .	192	316	253	222	520	569	983
1883 . . .	111	151	178	462	333	329	902
1884 . . .	203	147	248	335	665	395	933
1885 . . .	140	144	371	228	475	515	883
1886 . . .	153	(55)	412	240	381	467	860
1887 . . .	218	194	244	275	458	438	931
1888 . . .	187	252	282	308	462	534	1,029
1889 . . .	290	138	434	240	598	572	1,102
1890 . . .	164	221	351	363	404	572	1,109
1891 . . .	154	69	447	306	517	516	976
1892 . . .	190	129	464	271	496	593	1,054
1893 . . .	139	171	258	326	410	529	894
1894 . . .	161	137	360	329	487	497	987
1895 . . .	254	199	134	257	583	333	844
Thorshavn.							
1874 . . .	526	281	334	569	—	615	1,710
1875 . . .	400	308	335	428	969	643	1,471
1876 . . .	481	314	455	403	909	769	1,653
1877 . . .	501	301	169	608	904	470	1,579
1878 . .	495	186	239	493	1,103	425	1,413
1879 . . .	362	166	468	507	855	634	1,503
1880 . . .	484	269	235	520	991	504	1,508
1881 . . .	394	252	272	621	914	524	1,539
1882 . . .	669	315	342	456	1,290	657	1,782
1883 . . .	431	335	209	667	887	544	1,642
1884 . . .	518	283	394	763	1,185	677	1,958
1885 . . .	525	339	260	595	1,288	699	1,819
1886 . . .	327	278	600	446	922	878	1,651
1887 . . .	606	212	378	468	1,052	590	1,664
1888 . . .	475	371	287	660	943	658	1,793
1889 . . .	581	204	253	562	1,241	457	1,607
1890 . . .	458	166	313	506	1,027	479	1,443
1891 . . .	422	134	381	411	928	515	1,348
1892 . . .	581	316	406	451	992	722	1,754
1893 . . .	462	134	266	535	813	400	1,397
1894 . . .	501	194	106	528	1,036	300	1,329
1895 . . .	346	252	455	521	874	707	1,574
1896 . . .	525	310	332	546	1,046	642	1,813
Trinidad.							
1874 . . .	231	506	836	366	—	1,342	1,939
1875 . . .	125	183	808	434	491	991	1,550
1876 . .	155	495	1,001	432	589	1,496	2,083

	1 Trim.	2 Trim.	3 Trim.	4 Trim.	Oct.— Mars.	Avr.— Sept.	Année.
1877 . . .	244	381	704	503	676	1,085	1,832
1878 . . .	104	356	648	450	607	1,004	1,558
1879 . . .	224	533	594	310	674	1,127	1,661
1880 . . .	480	358	793	462	790	1,151	2,093
1881 . . .	38	439	744	450	500	1,183	1,671
1882 . . .	112	295	490	450	562	785	1,347
1883 . . .	64	513	749	467	514	1,262	1,793
1884 . . .	262	287	493	404	729	780	1,446
1885 . . .	94	231	419	353	498	650	1,097
1886 . . .	218	457	823	709	571	1,280	2,207
1887 . . .	147	318	521	643	856	839	1,629
1888 . . .	320	450	493	401	963	943	1,664
Trieste.							
1875 . . .	26	158	377	453	—	535	1,014
1876 . . .	301	494	432	205	754	926	1,432
1877 . . .	321	353	319	164	526	672	1,157
1878 . . .	104	272	411	507	268	683	1,294
1879 . . .	415	280	173	143	922	453	1,011
1880 . . .	90	281	384	487	233	665	1,242
1881 . . .	218	270	291	173	705	561	952
1882 . . .	126	230	449	331	299	679	1,136
1883 . . .	161	209	245	204	492	454	819
1884 . . .	73	378	291	203	277	669	945
1885 . . .	185	348	491	434	388	839	1,458
1886 . . .	223	335	192	356	657	527	1,106
1887 . . .	97	207	275	498	453	582	1,077
1888 . . .	270	252	189	235	766	441	946
1889 . . .	152	419	330	444	387	749	1,345
1890 . . .	81	288	141	294	525	429	804
1891 . . .	97	285	292	281	391	577	955
1892 . . .	287	409	245	265	568	654	1,206
1893 . . .	133	203	285	271	398	488	892
1894 . . .	87	320	197	223	358	517	827
Tromsö.							
1875 . . .	158	129	273	270	—	402	830
1876 . . .	170	140	225	293	440	365	828
1877 . . .	114	195	202	288	407	397	799
1878 . . .	493	177	243	267	781	420	1,180
1879 . . .	162	140	163	493	429	303	958
1880 . . .	509	273	295	417	1,002	568	1,494
1881 . . .	355	251	210	322	772	461	1,138
1882 . . .	597	159	387	134	919	542	1,277
1883 . . .	381	150	158	357	515	308	1,046
1884 . . .	368	140	263	421	725	403	1,192

	1 Trim.	2 Trim.	3 Trim.	4 Trim.	Oct.— Mars.	Avr.— Sept.	Année.
1885 . . .	265	147	224	415	686	371	1,051
1886 . . .	229	156	338	296	644	494	1,019
1887 . . .	471	226	175	280	767	401	1,152
1888 . . .	251	95	356	170	531	451	872
1889 . . .	313	160	236	316	480	396	1,025
1890 . . .	234	143	254	340	550	397	971
Upsala.							
1874 . . .	58	97	165	95	—	262	415
1875 . . .	75	59	94	84	170	153	312
1876 . . .	83	122	157	109	167	269	461
1877 . . .	164	63	255	139	273	318	621
1878 . . .	81	118	184	160	220	302	543
1879 . . .	56	148	179	101	216	327	484
1880 . . .	49	95	71	128	150	166	343
1881 . . .	85	72	182	88	213	254	427
1882 . . .	91	156	180	127	179	336	554
1883 . . .	67	97	330	153	194	427	647
1884 . . .	87	194	121	139	240	265	491
1885 . . .	82	120	260	167	221	380	629
1886 . . .	44	165	97	129	211	262	435
1887 . . .	47	100	197	100	176	197	444
1888 . . .	97	100	207	135	197	307	539
1889 . . .	76	74	270	105	211	344	525
1890 . . .	123	253	209	173	228	462	758
Umeå (Suède).							
1875 . . .	60	94	118	178	—	212	450
1876 . . .	120	115	234	96	298	349	565
1877 . . .	77	98	142	211	642	240	528
1878 . . .	64	115	157	180	275	272	516
1879 . . .	68	145	214	124	248	359	551
1880 . . .	66	89	114	131	190	203	400
1881 . . .	52	64	206	178	183	270	500
1882 . . .	88	123	230	167	226	353	608
1883 . . .	72	70	234	232	239	304	608
1884 . . .	104	136	76	109	336	212	425
1885 . . .	86	210	189	164	195	399	649
1886 . . .	97	136	206	150	261	342	589
1887 . . .	35	54	151	68	185	205	308
1888 . . .	32	66	169	134	120	235	421
1889 . . .	78	40	181	135	212	221	434
1890 . . .	95	81	205	146	230	286	527
Varsovie.							
1875 . . .	106	162	129	167	—	291	564
1876 . . .	93	157	247	81	260	404	578
1877 . . .	104	145	177	66	185	322	492
1878 . . .	106	163	176	98	172	339	543
1879 . . .	93	163	198	120	191	361	574
1880 . . .	54	135	154	184	174	289	527
1881 . . .	43	152	163	66	227	315	424
1882 . . .	65	145	355	109	131	500	674
1883 . . .	55	222	224	94	164	446	595
1884 . . .	76	161	52	142	170	213	431
1885 . . .	43	106	268	75	285	374	492
1886 . . .	85	120	66	130	160	186	401
1887 . . .	63	217	187	106	193	404	573
1888 . . .	140	184	242	87	246	426	653
1889 . . .	80	203	254	131	167	457	668
1890 . . .	140	183	242	87	271	425	652
Vestervig (Danemarc).							
1875 . . .	86	110	97	124	—	207	417
1876 . . .	142	78	196	143	266	274	559
1877 . . .	213	101	357	293	356	258	964
1878 . . .	126	121	212	217	419	333	676
1879 . . .	81	150	415	112	298	565	758
1880 . . .	89	104	244	226	201	348	663
1881 . . .	224	80	268	186	450	348	758
1882 . . .	103	216	231	242	289	447	792
1883 . . .	84	69	205	268	326	274	626
1884 . . .	144	101	268	262	412	369	775
1885 . . .	102	99	193	192	364	292	586
1886 . . .	101	416	172	234	293	288	623
1887 . . .	51	71	125	240	285	196	487
1888 . . .	93	129	155	191	333	284	568
1889 . . .	83	57	185	183	274	242	508
1890 . . .	114	127	192	122	297	319	555
Vienne.							
1875 . . .	166	107	154	263	—	257	690
1876 . . .	226	151	166	136	489	317	679
1877 . . .	181	134	139	131	317	273	585
1878 . . .	179	186	218	212	310	404	795
1879 . . .	157	374	194	136	369	578	861
1880 . . .	103	260	211	185	239	471	759
1881 . . .	139	167	191	123	324	358	620
1882 . . .	37	129	310	205	160	439	681
1883 . . .	96	215	135	85	301	348	529
1884 . . .	74	201	142	219	159	343	636
1885 . . .	75	233	201	142	294	434	651
1886 . . .	47	334	102	146	289	436	729

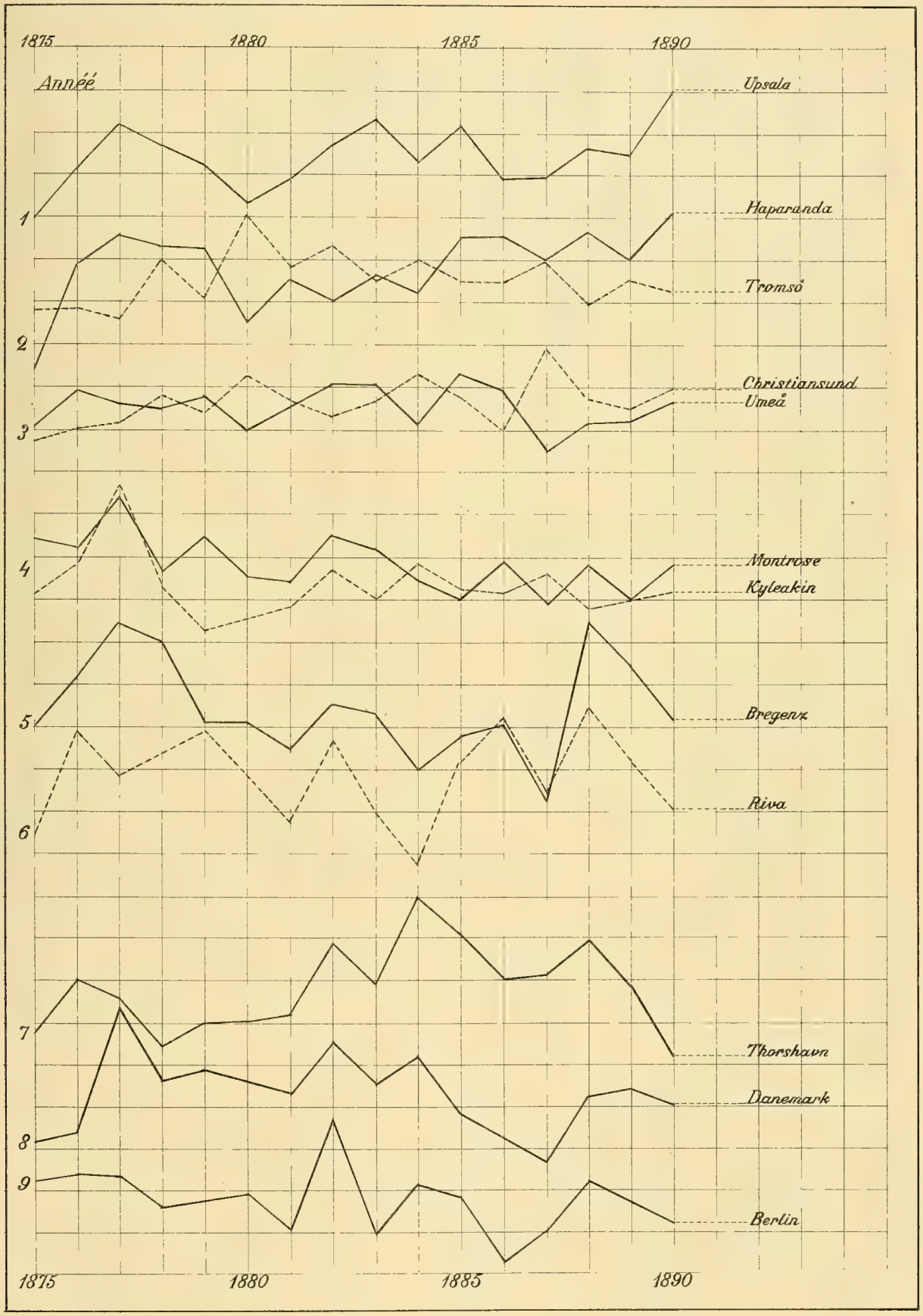
	1 Trim.	2 Trim.	3 Trim.	4 Trim.	Oct.— Mars.	Avr.— Sept.	Année.
1887 . . .	81	218	108	207	227	326	614
1888 . . .	208	255	141	125	415	396	729
1889 . . .	171	138	182	193	296	320	684
1890 . . .	59	224	225	92	252	449	600
1891 . . .	102	176	215	73	194	391	566
1892 . . .	140	258	217	81	213	475	696
1893 . . .	164	160	115	96	245	275	535
1894 . . .	47	206	192	135	143	398	580
1895 . . .	123	234	171	201	258	405	729
1896 . . .	113	189	281	64	314	470	647

Zi-ka-wei (Chine).

1875 . . .	196	599	542	249	—	1,141	1,586
1876 . . .	193	429	72	77	442	501	771
1877 . . .	177	258	309	244	254	667	988
1878 . . .	227	405	373	200	471	778	1,205
1879 . . .	251	503	368	149	451	871	1,271
1880 . . .	178	298	549	78	327	847	1,103
1881 . . .	195	379	552	215	273	931	1,341
1882 . . .	170	428	581	153	385	1,009	1,332
1883 . . .	163	393	313	156	316	706	1,025
1884 . . .	173	292	419	301	329	711	1,185
1885 . . .	190	533	287	103	491	820	1,113
1886 . . .	150	469	437	147	253	906	1,203
1887 . . .	269	408	465	29	416	873	1,171
1888 . . .	280	201	251	184	309	452	916
1889 . . .	172	290	658	341	356	948	1,461
1890 . . .	248	345	256	97	589	611	946
1891 . . .	155	186	826	249	252	1,012	1,416
1892 . . .	193	325	108	81	442	433	707
1893 . . .	162	311	581	93	243	892	1,147
1894 . . .	209	345	242	138	302	587	934
1895 . . .	157	381	387	92	295	768	1,017

Östersund (Suède).

1875 . . .	77	93	145	74	—	238	389
1876 . . .	60	95	218	51	134	313	424
1877 . . .	108	137	149	86	159	286	480
1878 . . .	44	123	211	91	130	334	469
1879 . . .	87	187	134	70	178	321	478
1880 . . .	27	40	138	79	97	178	284
1881 . . .	44	46	223	54	123	269	367
1882 . . .	48	110	177	96	102	287	431
1883 . . .	30	75	219	77	126	294	401
1884 . . .	41	115	121	77	118	236	354
1885 . . .	54	189	182	159	131	371	584
1886 . . .	30	159	205	95	189	364	489
1887 . . .	46	75	193	108	141	268	422
1888 . . .	41	57	178	124	149	235	400
1889 . . .	61	61	242	74	185	303	438
1890 . . .	50	202	259	109	124	461	620


1875
1880
1885
1890
Année
Upsala
Haparanda
Tromsö
Christiansund
Umeå
Montrose
Kyleakin
Bregenz
Riva
Thorshavn
Danemark
Berlin
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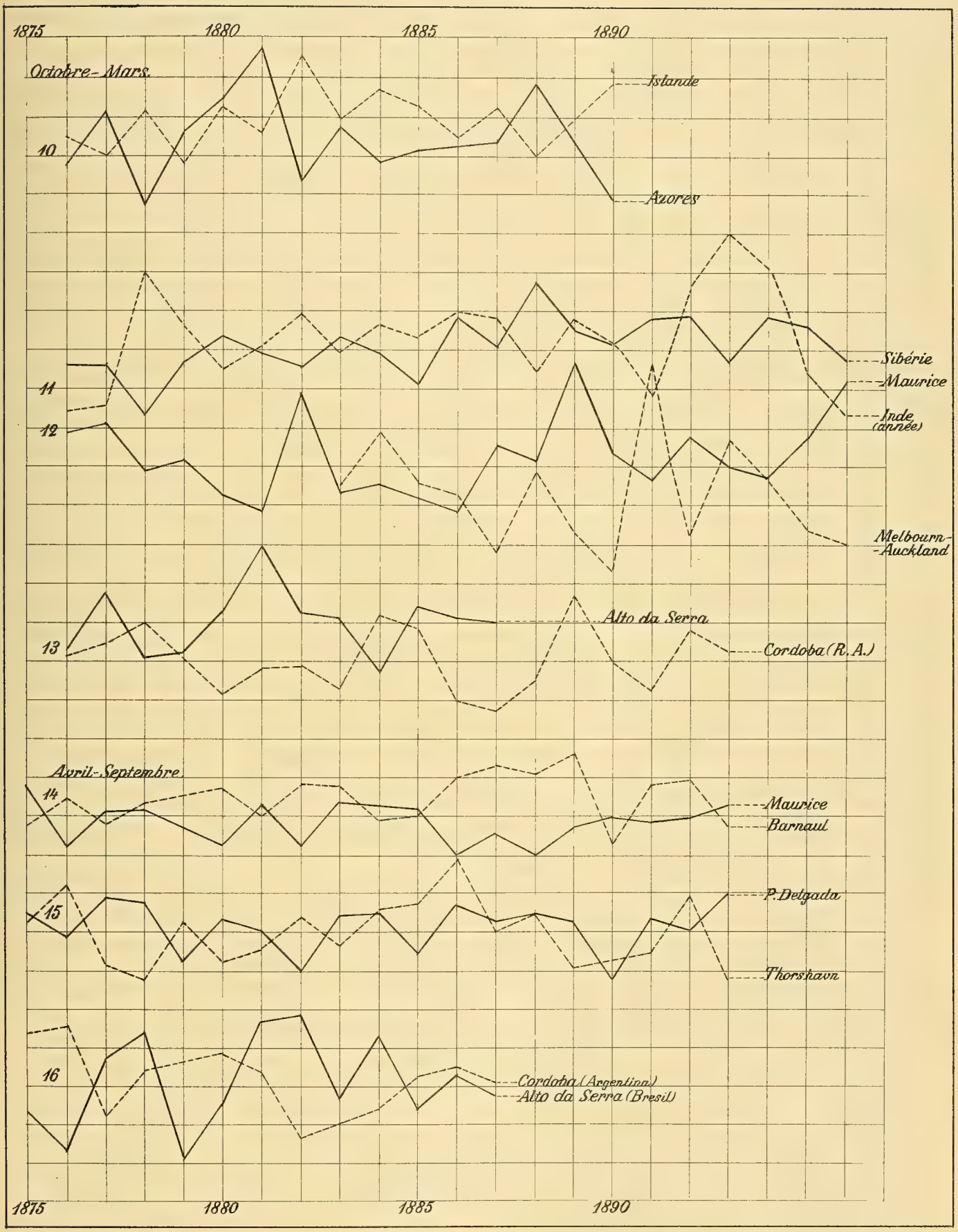
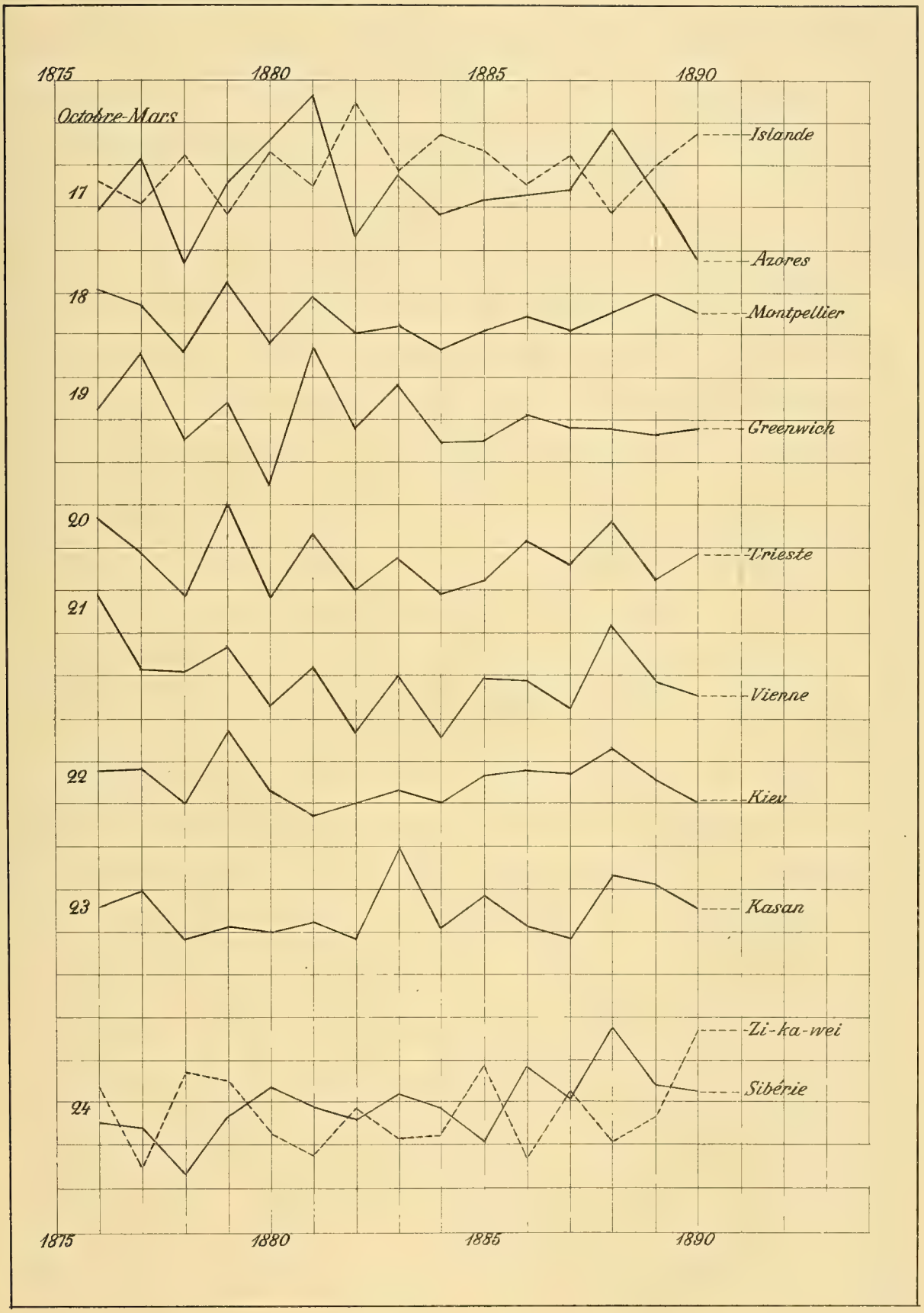

1875
1880
1885
1890
Octobre-Mars.
10
Islande
Azores
11
12
Sibérie
Maurice
Inde (année)
Melbourn-Auckland
13
Alto da Serra
Cordoba (R.A.)
Avril-Septembre
14
Maurice
Barnaul
15
P. Delgada
Thorshavn
16
Cordoba (Argentina)
Alto da Serra (Brésil)
1875
1880
1885
1890


1875
1880
1885
1890
Octobre-Mars
17
18
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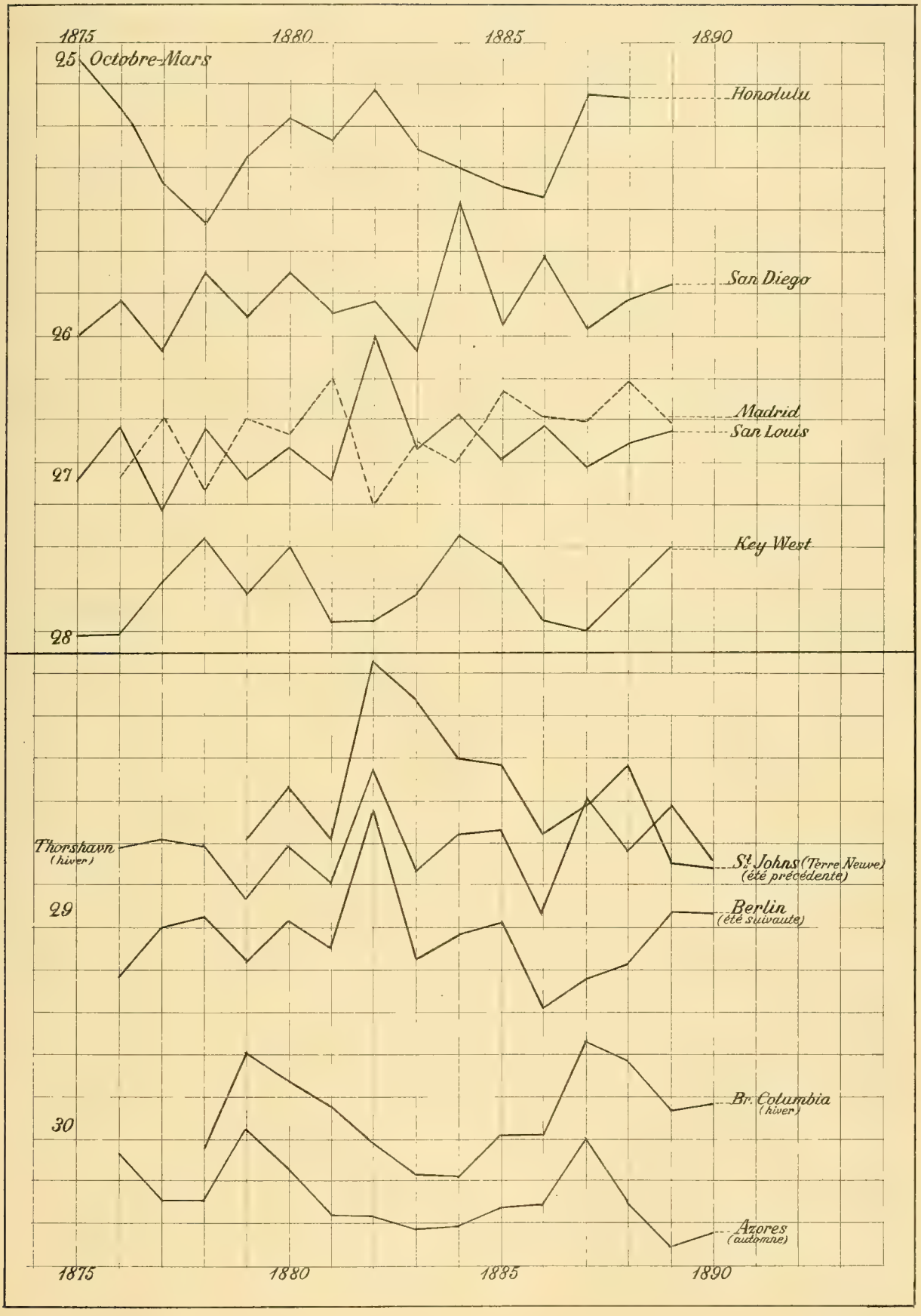
22
23
24
Islande
Azores
Montpellier
Greenwich
Trieste
Vienne
Kiev
Kasan
Zi-ka-wei
Sibérie
1875
1880
1885
1890


1875
1880
1885
1890
25 Octobre-Mars
Honolulu
San Diego
26
Madrid
San Louis
27
Key West
28
Thorshavn
(hiver)
St Johns (Terre Neuve)
(été précédente)
29
Berlin
(été suivante)
Br. Columbia
(hiver)
30
Azores
(automne)
1875
1880
1885
1890

KONGL. SVENSKA VETENSKAPS-AKADEMIENS HANDLINGAR. Bandet 32. N:o 5.

DIE COMPOSITEN

DER ERSTEN REGNELL'SCHEN EXPEDITION

VON

GUST. O. A:N MALME.

MIT 7 TAFELN

DER KÖNIGL. SCHWEDISCHEN AKADEMIE DER WISSENSCHAFTEN VORGELEGT DEN 12 APRIL 1899.

GEPRÜFT VON V. WITTROCK UND A. G. NATHORST.

STOCKHOLM
KUNGL. BOKTRYCKERIET P. A. NORSTEDT & SÖNER
1899.

Während der Reise[1] in Brasilien und Paraguay, die ich in den Jahren 1892—94 auf Kosten der Regnell'schen botanischen Stiftung unternahm, hatte ich mich nach der Instruktion, welche den beiden Reisenden gegeben worden war, hauptsächlich mit den Thallophyten zu beschäftigen. Ganz und gar konnte ich jedoch nicht die überaus reiche und grossartige Phanerogamenvegetation der bereisten Länder unberücksichtigt lassen. Da aber diesen Pflanzen nur eine sehr beschränkte Zeit gewidmet werden konnte, war es jedenfalls das zweckmässigste, die Aufmerksamkeit auf gewisse Familien oder Gattungen zu richten, und ich wählte mir schon am Anfang der Reise oder nach kurzem Aufenthalte in Brasilien die folgenden aus: *Compositæ*, *Asclepiadaceæ*, *Apocynaceæ*, *Xyridaceæ*, *Polygala*, *Peperomia* und *Burmannia*. Die von mir gesammelten Polygalaceæ hat Prof. Dr. R. Chodat in Genf bearbeitet.[2] Die Peperomien hat mein verehrter Freund H. Dahlstedt in Stockholm bestimmt, die Resultate der Bearbeitung sind aber noch nicht veröffentlicht worden.[3] Die Bearbeitung der Xyridaceen,[4] der Burmannien[5] und der Apocynaceen[6] habe ich selbst übernommen und vollendet. Die Asclepiadaceen liegen schon zum grössten Teil fertig vor und werden voraussichtlich im Laufe dieses Jahres publiciert werden. Was ich aus der einen oder anderen Ursache von anderen Familien sammelte, hoffe ich allmählich in meinen »Adjumenta» erwähnen zu können, wenn es nicht inzwischen in anderen botanischen Arbeiten berücksichtigt worden ist. In der vorliegenden Abhandlung bringe ich die Resultate der Bearbeitung der Compositen zur Veröffentlichung. Der Aufzählung der mitgebrachten Species und der Beschreibung der neuen Arten ist eine Einleitung vorangestellt, in der ich einige Bemerkungen über die geographische Verbreitung der brasilianischen Compositen und einige Beobachtungen über die Überwinterung, über den bis jetzt wenig untersuchten Sprossbau derselben und über den Schauapparat einiger Eupatorieen-Blüten mitteile.

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[1] Ein kurzer Bericht über die Reise findet sich in Malme, Die Flechten der ersten Regnell'schen Expedition. I. (Bihang till K. svenska Vet.-Akad. Handlingar. Band 23. Afd. III. N:o 13. Stockholm 1897.)

[2] Vergl. Malme, Die Polygalaceen der ersten Regnell'schen Expedition. (Öfversigt af Kongl. Vetenskaps-Akademiens Förhandlingar 1897. Pag. 225—248. Stockholm 1897.)

[3] Das mitgebrachte Spiritus-Material wurde von Dr. E. Jäderholm anatomisch untersucht. E. Jäderholm, Anatomiska studier öfver sydamerikanska Peperomier. Upsala 1898.

[4] Malme, Die Xyridaceen der ersten Regnell'schen Expedition. (Bihang till K. svenska Vet.-Akad. Handlingar. Band 22. Afd. III. N:o 2. Stockholm 1896.)

[5] Malme, Die Burmannien der ersten Regnell'schen Expedition. (Bihang till K. svenska Vet.-Akad. Handlingar. Band 22. Afd. III. N:o 8. Stockholm 1896.)

[6] Malme, Ex Herbario Regnelliano. Adjumenta ad floram phanerogamicam Brasiliæ . . . . cognoscendam. II. (Bihang till K. svenska Vet.-Akad. Handlingar. Band 24. Afd. III. N:o 10. Stockholm 1899.)

In der systematischen Anordnung und in der Begrenzung der Gattungen bin ich der Darstellung Benthams und Bakers in der Flora brasiliensis beinahe ohne Ausnahme gefolgt. Betreffs der Nomenklatur war es aber nötig, einige Veränderungen der Speciesnamen zu machen. Die wichtigsten sind die, dass die von Hooker und Arnott in Companion to the Botanical Magazine (1835) gegebenen Namen, die ein Jahr älter als die Decandolle'schen (Prodr. tom. V) sind, nach den Gesetzen der Priorität zur Geltung gebracht wurden. Den Neuerungen Kuntzes gegenüber verhalte ich mich noch im allgemeinen abwartend, und im grossen Ganzen teile ich die Auffassung, die in den Nomenklaturregeln für die Beamten des Königlichen botanischen Gartens und Museums zu Berlin (April 1897) ausgesprochen worden ist. Es kann zwar, bei strenger Durchführung des Prioritätsprincipes, berechtigt scheinen, z. B. den mehr als ein halbes Jahrhundert lang allgemein angenommenen Gattungsnamen *Mikania* Willd. zu unterdrücken und durch *Willoughbya* Neck. zu ersetzen, aber den Nutzen einer solchen Veränderung kann ich wenigstens gar nicht einsehen. Sie trägt nur dazu bei, Verwirrung zu stiften, besonders da bekanntlich eine Apocynaceen-Gattung, der der Name *Willoughbya* später gegeben worden ist, dann auch umgetauft werden muss. Überall sonst ist es wohl so, dass alte, schon lange der Vergessenheit anheimgefallene Ansprüche nach einer längeren oder kürzeren Frist sich verjähren und nachher nicht mehr wieder zur Geltung gebracht werden können. Nur die botanische Nomenklatur sollte diesem Gesetze der Verjährung nicht unterworfen sein? Gattungsnamen, die vor dem Jahre 1753 gegeben worden sind und später in dem (vermeintlich) ursprünglichen Sinne nicht gebraucht wurden, wieder aufzunehmen und dadurch eine Reihe Namensveränderungen durchzuführen, finde ich ganz und gar verwerflich. Vor dem genannten Jahre gab es bekanntlich keine binären Namen (wenigstens im jetzt gewöhnlichen Sinne); Regeln, die für die binären Namen geschaffen worden sind und gelten sollen, auf jene entfernte Zeit (vor d. J. 1753) anzuwenden, muss als durchaus absurd betrachtet werden. In einer überaus grossen Menge von Namensveränderungen haben übrigens die Anhänger und Nachahmer Kuntzes sich vollständig auf ein »jurare in verba magistri» beschränkt. Dass aber die Identifizierungen Kuntzes gar nicht ohne weiteres für richtig gehalten werden können, wird jeder einsehen und zugeben müssen, der die Gelegenheit gehabt hat, seine Pflanzenbestimmungen in irgend einem Falle zu prüfen.

Die Bearbeitung hat in der Botanischen Abteilung des Reichsmuseums zu Stockholm, wo ich als Assistent angestellt bin, und in dem Königl. botanischen Museum zu Berlin stattgefunden. Den Herren Direktoren des Berliner Museums, Geheimerat Prof. Dr. A. Engler und Prof. Dr. J. Urban, die mir immer das grösste und liebenswürdigste Entgegenkommen erzeigt haben, spreche ich hiermit meinen tiefgefühlten Dank aus. Im höchsten Grade bin ich auch meinem hochverehrten Chef Prof. Dr. V. B. Wittrock verbunden, der meine botanische Arbeit immer mit Rat und That unterstützt hat und noch unterstützt.

Schliesslich möchte ich auch diesmal erwähnen, dass Belegexemplare sämtlicher während der ersten Regnell'schen Expedition gesammelten Pflanzen, somit auch der hier behandelten Compositen, im Regnell'schen Herbar der Botanischen Abteilung des Reichsmuseums zu Stockholm aufbewahrt werden sollen.

Bemerkungen über die geographische Verbreitung der brasilianischen Compositen.

Der Staat **Rio Grande do Sul** wird, wenigstens zum allergrössten Teil, allgemein von den Pflanzengeographen zu der südbrasilianischen Provinz gerechnet, und zwar zu der Region der Napææ oder von *Araucaria brasiliana* und *Ilex paraguayensis*. Er liegt jedoch bekanntlich beinahe an der Grenze der argentinischen Pampas, und deshalb ist es nicht befremdend, dass man daselbst Florenelemente findet, die zu dem andinen Florenreich gehören. Dieselben sind jedoch gar nicht zahlreich. Dagegen hegt Rio Grande do Sul (nebst Uruguay und Entrerios) eine beträchtliche Anzahl endemischer Species, was wohl nicht nur aus der Beschaffenheit des Erdbodens und aus den klimatischen Verhältnissen, sondern auch aus der Entwicklungsgeschichte des Landes herrührt. Denn im Gegensatz zu dem allergrössten Teil der südbrasilianischen Provinz der Pflanzengeographen ist die grössere, südlich von der Serra Geral gelegene Hälfte des Staates im grossen Ganzen ein Neuland, wenn auch nicht in so hohem Grade, wie die Pampas von Buenos Aires.

Leider sind die Kenntnisse von der näheren geographischen Verbreitung der Pflanzen Südbrasiliens im engeren Sinne des Wortes — d. h. von Rio Grande do Sul, Santa Catharina und Paraná — sehr lückenhaft. Die grösste in Europa aufbewahrte Pflanzensammlung aus diesem Teile Brasiliens, besonders aus Rio Grande do Sul, ist zweifellos die von Sellow. Nähere Angaben über den Fundort der Sellow'schen Pflanzen findet man aber gewöhnlich weder in der Flora brasiliensis noch auf den Etiquetten der an verschiedenen Museen verteilten Exemplare. Von mehreren heisst es zwar, dass sie »in Brasilia australi» (oder »Brasilia austro-orientali») gesammelt worden sind, aber dieser Name (im weiteren Sinne) kann eben so gut Rio de Janeiro, Minas Geraes oder São Paulo als Rio Grande do Sul bedeuten. Erst durch die von Urban in Englers Botanischen Jahrbüchern 1893 veröffentlichte Sellow-Biographie, wo nähere Angaben über Sellows Reisen und seine verschiedenen Pflanzenkollektionen gegeben werden, *ist es ermöglicht worden*, über diese Frage ins Reine zu kommen. So weit ich weiss, hat sich aber bis jetzt Niemand die Mühe gegeben, die Sellow'schen Pflanzen im Berliner Museum, wo die Hauptsammlung aufbewahrt wird, durchzumustern, um genaue Fundortsangaben beizufügen bezw. zu veröffentlichen. Hier in Stockholm stehen mir recht wenige von diesen Pflanzen zur Verfügung, und zudem ist die Nummerierung derselben unvollständig. In vielen Fällen muss ich mich deshalb mit Vermutungen begnügen, die jedoch durch Vergleiche mit den Angaben anderer Sammler oft der Wahrheit sehr nahe gebracht werden

können. Im ganzen scheint mir aus der genaueren Kenntnis von Sellows Reisen und Sammlungen hervorzugehen, dass die Anzahl der in Rio Grande do Sul und den angrenzenden Teilen von Uruguay und Argentinien endemischen Species, wenigstens diejenige der Compositen, etwas grösser ist, als man in der Flora brasiliensis angiebt. Sagt doch Baker selbst, l. c. fasc. 93, pag. 409: »Hi numeri adhuc augentur . . . . . .; verisimiliter quoque e speciebus »dubiæ sedis», plerisque Selloanis e »Brasilia austro-orientali», nonnullæ huc (ad Napæas) pertinent».

Über die Verteilung der Pflanzen auf die verschiedenen Formationen — Wald, Capão, Campo, Sumpfformationen u. s. w. — geben die älteren Sammlungen im allgemeinen keine Aufschlüsse. Nach meiner Erfahrung verhalten sich aber die einzelnen Formationen betreffs der pflanzengeographischen Elemente recht verschieden. Der Wald in Rio Grande do Sul, wenigstens an den Abhängen der Serra Geral, scheint viel mehr Dryas- (bezw. Oreas-) Elemente zu hegen, als die Campos. Er stimmt auch physiognomisch mehr mit den Wäldern in den Umgebungen von Santos und Rio de Janeiro oder an den Flüssen in der Oreas-Region überein, als die Campos mit den entsprechenden Bildungen in Minas Geraes, wenn auch die Epiphyten und Lianen keine solche Fülle erreicht haben. Leider sammelte ich recht wenige Wald-Phanerogamen, und kann deshalb, wenigstens vorläufig, das gesagte nur mit ein paar Beispielen beleuchten.

Die *Peperomien* gehören, wenigstens was Brasilien betrifft, im allgemeinen zu der Wald- (bezw. Capão-)Flora und bilden bekanntlich eine hauptsächlich intertropische Gattung. In den Wäldern und Gehölzen von Rio Grande do Sul waren Peperomien gar nicht selten, und ich habe deren nicht weniger als 14 gesammelt, ohne Zweifel eine beträchtliche Anzahl, wenn man bedenkt, dass wir hier an der Südgrenze des Verbreitungsareales der Gattung stehen. Die meisten der gefundenen Species sind mit den in São Paulo und Minas Geraes (z. B. in der Umgegend von Caldas) vorkommenden durchaus identisch, die übrigen mit denselben sehr eng verwandt. Anders verhält es sich mit den mehrjährigen, in den Campos wachsenden *Polygalen*, besonders denjenigen, die an trockenen Lokalitäten vorkommen. Viele derselben, und zwar die auffälligsten, z. B. *P. Duarteana* S:t Hil., *P. extra-axillaris* Chod., *P. linoides* Poir. und *P. Wittrockiana* Chod., gehören zu den endemischen Species.

Die im Walde oder in den »Capoeiras» wachsenden Apocynaceen *Echites coalita* Vell., *E. peltata* Vell. und *Forsteronia refracta* Müll. Arg. kommen auch weiter nördlich häufig vor; die an trockneren Lokalitäten auftretende *Forsteronia glabrescens* Müll. Arg., wenigstens die typische Form, scheint dagegen zu den endemischen gezählt werden zu müssen. Dasselbe gilt von den Asclepiadaceen. Die meisten der im Walde — im Urwalde oder in den Capoeiras — wachsenden Species, z. B. *Amphistelma aphyllum* (Dne.) Fourn., *Araujia sericifera* Brot., *Cyathostelma latipes* (Dne.) Fourn. und *Oxypetalum appendiculatum* Mart. & Zucc., gehören zu den Dryas- bezw. Oreas-Elementen; die in den Campos auftretenden, z. B. *Araujia megapotamica* G. Don (im Gebüsch an trockenen Lokalitäten), *Rhyssostelma*, *Oxypetalum Arnottianum* Buek, *O. parviflorum* Dne. und *O. tomentosum* Wight & Arn., sind endemisch.

Die Campos in Rio Grande do Sul weichen dagegen, wie oben erwähnt wurde, physiognomisch von denjenigen in Minas Geraes oder in Matto Grosso sehr beträchtlich

ab. Sie sind im allgemeinen Grasfluren ohne Bäume oder höhere Sträucher. Wenn man die Küstengegend, die sehr sandig, nicht selten wüstenartig ist und wo im Flugsande oft eine sehr ärmliche, krüppelige Vegetation ihr Dasein fristet, nicht in Betracht zieht, ist der Erdboden der riograndischen Campos viel reicher an Lehm und viel ärmer an Kies bezw. Sand, als diejenigen der Oreasregion. An trockenen, der Heftigkeit des Windes ausgesetzten Lokalitäten ist die Pflanzendecke eine recht niedrige. Wenn Sträucher überhaupt vorkommen, z. B. *Heterothalamus psiadioides* Less., *Baccharis coridifolia* DC. und Myrtaceen, besonders Arten der Gattung *Campomanesia*, so erreicht ihre Höhe gewöhnlich nicht 1 Meter. Am Rande der Wälder, die besonders die Abhänge der Serra Geral bekleiden oder hier und da an den Flüssen auftreten, oder der Wäldchen (capões), die an geeigneten Lokalitäten vorkommen, wo aus irgend einem Grunde die Feuchtigkeit etwas grösser ist, ist der Boden lockerer, humusreicher und feuchter. Hier, wo übrigens der Wind seine austrocknende Thätigkeit nicht in so hohem Grade ausübt, wird die Pflanzendecke viel höher. Die Gräser und Halbgräser gewähren zahlreichen Schlingpflanzen, z. B. *Mikania cordifolia* (L. fil.) Willd. und *Oxypetalum macrolepis* Dne., eine vorzügliche Stütze, und die Sträucher werden zahlreicher und höher. Hier findet man viele der riograndischen Flora charakteristische strauchartige Compositen, z. B. *Eupatorium nummularia* Hook. & Arn., *E. multicrenulatum* Sch. Bip., *E. serratum* Spreng. und *Baccharis Glaziovii* Baker. Ist der Boden stark lehmhaltig und somit weniger locker, bildet oft *Baccharis articulata* (Lam.) Pers. ausgedehnte Bestände, die durch ihre eigentümliche blaugrüne Farbe schon von ferne leicht zu erkennen sind. Dergleichen »Baccharideta» kommen jedoch bisweilen auch in den offenen Campos vor. An anderen Stellen entsteht ein dichtes, mehr als mannshohes Gebüsch aus *Baccharis dracunculifolia* DC., welche sonst eine Charakterpflanze der »Capoeiras» (der alten, verlassenen Pflanzungen) ist. Die »Cerrados», die durch ihre bizarren, niedrigen, knorrigen, dickborkigen Bäume der Vegetation der brasilianischen Hochebene ein so seltsames Gepräge verleihen, fehlen in Rio Grande do Sul ganz und gar. Nur bei Belem Velho in der Nähe von Porto Alegre und auf einem Hügel unweit der Stadt Santa Maria fand ich einzelne Individuen eines Baumes, der die Charaktere der »arbores campestres» besass, den ich aber noch nicht habe bestimmen können, da keine Blüten hierher mitgebracht worden sind.

Man darf sich aber nicht die riograndische »Campanha» als eine ununterbrochene Grasebene vorstellen. Der Jacuhy-Vacacahy und seine Nebenflüsse werden im allgemeinen durch einen Waldstreifen umrandet, und übrigens liegen grössere oder kleinere »Capões» (Wäldchen) über die ganze Ebene zerstreut. Im Februar 1893 bestieg ich eines Tages den Agudo, einen verhältnismässig recht hohen Berg in der deutschen Kolonie Santo Angelo. Von der Spitze aus hatte man eine grossartige Aussicht, die einen Überblick über die grossen Züge der Physiognomie der Campanha gestattete. Ich erlaube mir einige diesbezügliche Zeilen aus meinem Tagebuche in Übersetzung mitzuteilen: . . . . . »Nach Süden und Südosten breitet sich die Campanha riograndense aus wie ein graugrünes Grasmeer, aus dem zahlreiche Inseln (die Capões) mit dunkelgrünen Bäumen emporragen. Hier und da treten zum Vorschein anders gefärbte Untiefen, entweder grössere, gräuliche mit grüner Umrandung oder kleinere, ganz grüne (die letzteren sind grössere Lachen oder

kleinere Sümpfe, wo nach den im Januar oft vorkommenden Regengüssen zahlreiche einjährige Pflanzen auftreten; die ersteren grössere Sümpfe mit hohen Halbgräsern und oft mit zerstreuten Bäumen der dickborkigen, knorrigästigen *Erythrina crista galli* L., die fast das ganze Jahr hindurch aussieht, als wäre sie halb vertrocknet)».

In den Wäldern kommen recht wenige Compositen vor, und diese scheinen im allgemeinen ihre Südgrenze hier, an der Serra Gerral, zu haben (z. B. *Baccharis anomala* DC., *Mikania apiifolia* DC. und *M. chlorolepis* Baker). Auch in den Capoeiras und in den Pflanzungen, wo oft zahlreiche Compositen vorkommen, findet man nicht viele endemische Species. In den letzteren und im allgemeinen an Lokalitäten, wo die Erde von ihrer Pflanzendecke entblösst worden ist, treten zuerst, wie gewöhnlich, zahlreiche einjährige Pflanzen auf. Unter den Compositen spielen die Species der Gattung *Erechthites*, *E. valerianæfolia* (Wolf) DC. und *E. hieraciifolia* (L.) Rafin., und *Porophyllum ruderale* (Jacq.) Cass. die wichtigste Rolle. Später kommen die mehrjährigen Kräuter, z. B. *Eupatorium inulæfolium* H. B. K., *Eupatorium picturatum* Malme, *E. foliatum* (Sch. Bip.) Hieron., *Solidago microglossa* DC., *Polymnia silphioides* DC., *Blainvillea biaristata* DC. und *Elephantopus scaber* L. var. *tomentosus* (L.) Sch. Bip., zum Vorschein. Allmählich werden diese Kräuter von Sträuchern verdrängt, unter denen *Baccharis dracunculifolia* DC., *B. platensis* Spreng. und *B. punctulata* DC. verdienen hervorgehoben zu werden. Besonders während die Capoeira noch jung ist, wetteifern hier zahlreiche Schling- und Kletterpflanzen, z. B. Mikanien und Mutisien, ihre Blätter und Blüten über das Dickicht zu erheben.

Aber die allergrösste Anzahl von Compositen findet man in den Campos, wo, wenigstens in den Monaten März und April, etwa die Hälfte der blühenden Pflanzen zu dieser Familie gehört. Da es kaum zweckmässig wäre, die von mir beobachteten sämtlich aufzuzählen, beschränke ich mich darauf, einige der auffälligsten und häufigsten zu erwähnen: *Achyrocline satureoides* (Lam.) DC. (mehrere Varietäten), *Asteropsis macrocephala* Less., *Baccharis coridifolia* DC., *B. tenuifolia* DC. var. *leptophylla* (DC.), *Chaptalia piloselloides* (Vahl) Baker, *Eupatorium subhastatum* Hook. & Arn., *E. squarrulosum* Hook. & Arn., *E. oblongifolium* (Spreng.) Baker und *E. ligulæfolium* Hook. & Arn., *Heterothalamus psiadioides* Less., *Hysterionica pinifolia* (Poir.) Baker, *Lucilia acutifolia* (Poir.) Cass., *Mikania ternifolia* DC., *Pamphalea Commersonii* Cass., viele Species der Gattung *Pterocaulon*, z. B. *Pt. angustifolium* DC. und *Pt. Lorentzii* Malme, *Sommerfeltia spinulosa* Less., *Spilanthes arnicoides* DC., *Stenachenium campestre* Baker, viele *Steviæ*, *Trichocline foliosa* Hook. & Arn., *Tr. macrocephala* Less., *Vernonia chamædrys* Less., *V. flexuosa* Sims, *V. nudiflora* Less. und *V. Sellowii* Less. Diese sind alle mehrjährige Kräuter (Stauden), Halbsträucher oder kleine Sträucher; einjährige Compositen kommen in den trockenen Campos sehr selten vor und im allgemeinen nur an den Wegen, wo sie wohl in den allermeisten Fällen eingeschleppt sind. An feuchten Lokalitäten findet man hier und da Anuellen, z. B. *Eupatorium hecatanthum* (DC.) Baker, *Jægeria hirta* (Lag.) Less. und *Erechthites hieraciifolia* (L.) Rafin.; die meisten sind jedoch auch hier Sträucher oder Stauden, z. B. an Lokalitäten, wo der Boden entblösst liegt, *Pluchea quitoc* DC. und *Eupatorium Candolleanum* Hook. & Arn., unter den hohen Gräsern und Halbgräsern *Eupatorium lætevirens* Hook. & Arn., *Eupatorium tremulum* Hook. & Arn., *Leu-*

copsis Tweediei (HOOK. & ARN.) BAKER, *Jungia floribunda* LESS., *Baccharis leucopappa* DC., *Eupatorium serratum* SPRENG. und mehrere andere der sonst am Rande der Wälder vorkommenden Sträucher. Das sandige Strandgebiet (in der Nähe von den Städten Rio Grande und São José del Norte), wo ich leider nur einige Tage und zwar unter recht ungünstigen Verhältnissen sammelte, hegt mehrere schon durch ihre Tracht leicht erkenntliche Species, unter denen *Spilanthes leptophylla* DC., *Senecio crassiflorus* LAM. var. *tricuspis* BAKER und *Noticastrum eriophorum* REMY besonders hervorgehoben werden sollen.

Wer mit der brasilianischen Flora einigermassen vertraut ist, wird leicht finden, dass sehr viele der oben erwähnten Campos-Compositen (bezw. Sumpfpflanzen und psammophilen Pflanzen) in Rio Grande do Sul (Uruguay und Entrerios) endemisch sind; ich brauche nur an die *Eupatorien* und *Trichoclinen*, die eigentümliche *Pamphalea Commersonii* CASS., *Heterothalamus psiadioides* LESS., *Sommerfeltia spinulosa* LESS. und *Stenachenium campestre* BAKER zu erinnern. Weiter unten werde ich zeigen, dass viele derselben im Sprossbau und betreffs der Überwinterung Verhältnisse darbieten, die den Compositen der Oreasregion im grossen Ganzen fast fremd sind.

Was die einzelnen Tribus betrifft, ist zu bemerken, dass von den **Vernonieen** nur die beiden Gattungen *Vernonia* und *Elephantopus* (möglicherweise auch *Centratherum*, da sie in den argentinischen Missiones und in Paraguay angetroffen worden ist) vertreten sind. Die grossen Oreas- (bezw. Dryas-) Gattungen *Vanillosmopsis*, *Piptocarpha*, *Stilpnopappus*, *Piptolepis*, *Eremanthus* und *Lychnophora*, welche hauptsächlich in den Cerrados und in den Hochgebirgen vorkommen, fehlen vollständig. Die beiden in Rio Grande do Sul gefundenen *Elephantopus*-Arten sind weit verbreitet und haben hier ihre Südgrenze. Von Vernonien giebt es verhältnismässig viele, und einige spielen eine nicht geringe Rolle in der Camposvegetation von Rio Grande, z. B. *V. chamædrys* LESS., *V. platensis* SPRENG., *V. Tweedieana* BAKER und *V. nudiflora* LESS. Die meisten sind endemisch, z. B. *V. Sellowii* LESS., *V. flexuosa* SIMS und *V. platensis* SPRENG.; *V. chamædrys* LESS., *V. Tweedieana* BAKER und *V. nitidula* LESS. sind auch in Paraguay angetroffen worden; bis nach Minas Geraes gehen *V. megapotamica* SPRENG., *V. brevifolia* LESS. und *V. glabrata* LESS.; *V. nudiflora* LESS. hat eine recht weite Verbreitung in den argentinischen Central-Provinzen.

Die **Eupatorieen** sind durch die Gattungen *Adenostemma (Gymnocoronis)*, *Stevia*, *Mikania (Kanimia)* und *Eupatorium* vertreten. Das weit verbreitete *Adenostemma viscosum* FORST. hat seine Südgrenze in Rio Grande do Sul; in Entrerios ist es noch nicht gesammelt worden. Die *Steviæ* sind zweifellos recht zahlreich, obgleich ich nicht viele mitgebracht habe. Die Gattung ist sehr polymorph und die Verbreitung der südamerikanischen Arten wenig bekannt. Ob irgend welche der Oreas-Region und Rio Grande do Sul gemeinsam sind, scheint mir sehr fraglich zu sein. Was die *Mikanien* betrifft, wurde schon oben hervorgehoben, dass die im Walde oder in den Capoeiras wachsenden *M. chlorolepis* BAKER, *M. involucrata* HOOK. & ARN. und *M. apiifolia* DC. an der Serra Geral ihre Südgrenze zu haben scheinen. Die camposbewohnende *M. ternifolia* DC. (sowie die ihr verwandten Species) ist endemisch. Über die geographische Verbreitung der zahlreichen zu *M. scandens* (L.) WILLD. gerechneten Formen, die eine genaue Revision von

nöten haben, lässt sich vorläufig nichts mit Sicherheit sagen. Die vielen, besonders in den Campos, sowohl an trockenen Lokalitäten (die eigentlichen Campos-Pflanzen) als auch an mehr oder weniger feuchten (mehr oder weniger hygrophile Formen), vorkommenden *Eupatorien* sind zum grössten Teile endemisch oder kommen ausserdem in den argentinischen Central-Provinzen und in Paraguay mehr oder weniger verbreitet vor, z. B. *E. foliatum* (Sch. Bip.) Baker (eine Capoeira-Pflanze), *E. squarrulosum* Hook. & Arn. (soll jedoch auch in São Paulo angetroffen worden sein), *E. subhastatum* Hook. & Arn. (*E. hirsutum* Hook. & Arn. = *E. trichophorum* DC., das auch in São Paulo und Minas Geraes vorkommt, ist als eine selbständige Species anzusehen), *E. bracteatum* Hook. & Arn., *E. caaguazuense* Hieron., *E. Tweedieanum* Hook. & Arn., *E. lætevirens* Hook. & Arn., *E. ligulæfolium* Hook. & Arn., *E. serratum* Spreng., *E. nummularia* Hook. & Arn., *E. oblongifolium* (Spreng.) Baker, *E. multicrenulatum* Sch. Bip., *E. grande* Sch. Bip., *E. Candolleanum* Hook. & Arn. und *E. hecatanthum* (DC.) Baker. Nur sehr wenige kommen ausserdem auch in der Oreas- oder der Dryasregion vor, und es sind dies im Allgemeinen Species, welche eine sehr weite geographische Verbreitung haben, z. B. *E. inulæfolium* H. B. K., *E. lævigatum* Lam., *E. macrocephalum* Less., *E. betonicæforme* DC., *E. bupleurifolium* DC. und *E. tremulum* Hook. & Arn.

Wenn man die Gattung *Baccharis* nicht mit in Betracht zieht, sind die **Astereen** in Rio Grande do Sul stärker vertreten, als in irgend einem anderen Teile Brasiliens, und zwar auch durch endemische Gattungen, wie *Asteropsis* und *Sommerfeltia*. In dieser Tribus hat man auch die auffälligsten andinen Elemente der riograndischen Flora zu suchen, z. B. *Noticastrum sericeum* (Less.) Sch. Bip. und *N. eriophorum* Remy. Unter den endemischen oder ausserhalb Rio Grande do Sul — Uruguay — Entrerios nur in den argentinischen Central-Provinzen vorkommenden Species sind zu erwähnen: mehrere Species der Gattung *Grindelia*, z. B. *G. puberula* Hook. & Arn., *Noticastrum calendulaceum* (Griseb.), *Hysterionica pinifolia* (Poir.) Baker und *H. montevidensis* (Spreng.) Baker, *Podocoma hieraciifolia* (Poir.) Cass. und *P. hirsuta* (Hook. & Arn.) Baker, *Heterothalamus psiadioides* Less., *Aster calocephalus* Malme und *A. setosus* Baker und *Conyza arguta* Less. Eine weite Verbreitung in Brasilien, sowie auch ausserhalb dieses Landes haben *Solidago microglossa* DC., *Aster exilis* Ell., *Erigeron bonariensis* L. und *Conyza chilensis* Spreng. Die nur der Oreas- (bezw. Dryas-)Region und Rio Grande do Sul nebst den angrenzenden Teilen der argentinischen Republik gemeinsamen Arten sind recht selten; in meiner Sammlung finden sich deren nur drei und zwar *Leucopsis Tweediei* (Hook. & Arn.) Baker, *Conyza triplinervia* Less. und *C. notobellidiastrum* Griseb. Auch aus der Gattung *Baccharis*, die bekanntlich in der brasilianischen Hochebene massenhaft auftritt, finden sich verhältnismässig recht viele endemische Species in Rio Grande do Sul (und den angrenzenden Teilen von Argentina), z. B. *B. articulata* (Lam.) Pers., *B. artemisioides* Hook. & Arn. (vielleicht besser zu den andinen Elementen zu zählen), *B. coridifolia* DC., *B. platensis* Spreng. und *B. pentodonta* Malme. Häufig kommen jedoch auch mehrere Species vor, die in der südbrasilianischen Provinz der Pflanzengeographen weit verbreitet sind, z. B. *B. genistelloides* (Lam.) Pers. **trimera* (Less.) DC., *B. Glaziovii* Baker, *B. tenuifolia* DC., *B. megapotamica* Spreng., *B. dracunculifolia* DC., *B. punctulata* DC. und *B. anomala* DC.

Von **Inuleen** giebt es in ganz Brasilien nur recht wenige. In Rio Grande do Sul (nebst Uruguay und Entrerios) sind die Gattungen *Stenachenium*, *Pluchea* (*Tessaria*), *Pterocaulon*, *Lucilia*, *Achyrocline*, *Facelis*, *Chevreulia* (*Filago*) und *Gnaphalium* vertreten. Die Gattung *Pterocaulon* werde ich an anderer Stelle behandeln und daselbst auch das mitteilen, was ich über die geographische Verbreitung der Species und Subspecies habe ermitteln können. Hier sei nur bemerkt, dass *Pt. polystachyum* DC. und *Pt. Lorentzii* Malme zu den endemischen zu zählen sind. *Stenachenium* kommt nur in unserem Gebiete vor. Unter den endemischen Species sind ferner *Lucilia acutifolia* (Poir.) Cass. und *L. nitens* Less. zu erwähnen. *Tessaria absinthoides* DC., die möglicherweise in Rio Grande zu finden ist, da sie in Uruguay vorkommt, und *Chevreulia stolonifera* Cass. gehören zu den andinen Pflanzen. *Pluchea quitoc* DC., *Achyrocline satureoides* (Lam.) DC. (sens. lat.), *A. alata* (H. B. K.) DC. und *Gnaphalium purpureum* L. **spicatum* Lam. sind in Brasilien sowie auch in anderen Teilen Südamerikas weit verbreitet.

An **Heliantheen** ist unser Gebiet, im Vergleich zu der Oreas-Region, sehr arm. Die häufigsten, z. B. *Xanthium spinosum* L., *Acanthospermum xanthioides* (H. B. K.) DC., (*Eclipta alba* [L.] Hassk.) und *Galinsoga parviflora* Cav. sind ohne Zweifel eingeschleppt. Die einzigen endemischen, die ich gesammelt habe, sind *Polymnia silphioides* DC. (wenn die in der Umgegend von Caldas in Minas Geraes gefundene *P. macroscypha* Baker zu trennen ist), *Eclipta lanceolata* DC., *E. elliptica* DC., *Blainvillea biaristata* DC., *Viguiera pilosa* Baker, *V. stenophylla* (Hook. & Arn.) Griseb. und *Spilanthes leptophylla* DC. *Calea pinnatifida* (R. Br.) Less. gehört zu den Dryaden; *Aspilia setosa* Griseb. und *Verbesina sordescens* DC. sind den Regionen der Oreaden und der Napæen gemeinsam, *Enhydra anagallis* Gardn. und *Jægeria hirta* (Lag.) Less. weit verbreitet, nicht nur in Brasilien, sondern auch in anderen Teilen von Südamerika, die letztere, welche anderwärts eine »planta agrestis» et synanthropica sein soll, sogar in Mexiko und Centralamerika.

Die **Helenieen** verhalten sich in Brasilien etwa wie die Inuleen. Unter den von mir in Rio Grande do Sul gesammelten gehören *Porophyllum linifolium* (L.) DC. und *P. brevifolium* (Hook. & Arn.) Malme, vielleicht auch *P. lanceolatum* DC., zu den endemischen; *Porophyllum ruderale* (Jacq.) Cass. und *Tagetes minuta* L. sind synanthropisch und als solche weit verbreitet. Ausserdem werden einige sonst in den Pampas vorkommende Helenieen, z. B. *Gaillardia megapotamica* (Spreng.) Baker, *Cephalophora heterophylla* (Juss.) Less. und *Jaumea linearifolia* Pers. als in Rio Grande von Tweedie und Sellow gefunden in der Flora brasiliensis aufgeführt.

Die **Anthemideen**, mit Ausnahme von den in Südamerika einheimischen und weit verbreiteten *Soliven*, sind in später Zeit aus der alten Welt eingeschleppt worden.

Unter den **Cichorieen** ist *Hieracium Commersonii* Monn. in unserem Gebiete endemisch, die hygrophile *Hypochæris Gardneri* (Sch. Bip.) Baker und die synanthropische *Hypochæris brasiliensis* (Less.) Griseb. in Brasilien weit verbreitet, *Taraxacum officinale* Web. & Wigg., *Lactuca virosa* L., *Sonchus asper* (L.) All. und *S. oleraceus* L. in jüngerer Zeit aus Europa eingeschleppt.

Die **Senecioneen** sind durch zwei wildwachsende Gattungen *Erechthites* und *Senecio* vertreten. Die beiden hauptsächlich synanthropischen *Erechthites hieraciifolia* (L.) Rafin. und *E. valerianæfolia* (Wolf) DC. haben eine sehr weite Verbreitung in Amerika und sind

in jüngster Zeit sogar in Europa eingeschleppt worden. *Erechthites missionum* Malme, *Senecio crassiflorus* (Lam.) var. *tricuspis* Baker, *S. heterotrichius* DC., *S. pinnatus* Poir. var. *leptolobus* (DC.) Baker und mehrere von mir nicht gesammelte Species sind in Rio Grande do Sul, Uruguay und Entrerios endemisch. *Senecio brasiliensis* (Spreng.) Less. und *S. icoglossus* DC. kommen ausserdem in der Oreas- bezw. Dryas-Region vor.

Unter den **Mutisieen** ist die Gattung *Pamphalea* in unserem Gebiete endemisch; ich habe nur eine einzige Species und zwar die mehrjährige *P. Commersonii* Cass. gefunden. Endemisch sind ferner *Trichocline foliosa* Hook. & Arn., *Tr. macrocephala* Less., *Moquinia mollissima* Malme, mehrere von mir nicht beobachtete Arten der Gattung *Perezia* nebst *Schlechtendalia luzulæfolia* Less. und *Onoseris corymbosa* (Less.) Benth.; dasselbe ist wahrscheinlich auch der Fall mit *Moquinia polymorpha* (Less.) DC. var. *obtusifolia* (Less.) DC., die vielleicht besser als eine selbständige Species zu betrachten ist. *Chuquiragua glabra* (Spreng.) Baker, *Mutisia speciosa* (Ait. fil.) Hook., *M. coccinea* St. Hil. und *M. campanulata* Less. sind der Region der Dryaden und derjenigen der Napæen gemeinsam, kommen aber, obgleich mehr vereinzelt, auch in der Oreas-Region vor; ihre Südgrenze haben sie in Rio Grande do Sul. *Trixis mollissima* D. Don., *T. verbasciformis* Less., *T. Lessingii* DC. und *T. brasiliensis* (L.) DC. finden sich sowohl in Rio Grande do Sul (und den angrenzenden Staaten) als in der Region der Oreaden, wo die beiden letzteren jedoch spärlich zu sein scheinen. *Trichocline incana* (Lam.) Cass. ist eine weit verbreitete Pampas-Pflanze, und *Chaptalia exscapa* (Pers.) Baker ist zweifellos zu den andinen Elementen der Flora von Rio Grande zu zählen. *Jungia floribunda* Less., *Trixis divaricata* (H. B. K.) Spreng., *Chaptalia nutans* (L.) Hemsl., *Ch. integrifolia* (Cass.) Baker und *Ch. piloselloides* (Vahl) Baker sind in ganz Südamerika weit verbreitet (teilweise sogar in Westindien); die letztgenannte fehlt jedoch, soweit bekannt ist, in der brasilianischen Hochebene vollständig.

In **Paraguay** hielt ich mich viel zu kurz, und zwar zu einer recht ungünstigen Zeit auf, um die Compositen des Landes genauer kennen zu lernen. Die grossen Balansaschen Sammlungen standen mir bis jetzt nur teilweise zur Verfügung, und die Sammlung von Anisits enthält recht wenige Compositen. Die paraguayische Flora ist bekanntlich eine gemischte, deren meiste Pflanzen zu den Napæen und zu den Oreaden zu zählen sind. Zu denselben gesellen sich teils Pampas- und andine Pflanzen, teils, besonders an den Ufern des Paraguayflusses, Pflanzen, die man sonst nur in den nördlichen und in den östlichen Teilen Brasiliens vorfindet, die aber in der Region der Oreaden und derjenigen der Napæen zu fehlen scheinen. Endemische Compositen-Gattungen sind mir nicht aus Paraguay bekannt; endemische Species finden sich dagegen hin und wieder, z. B. (aus meiner Sammlung) *Calea clematidea* Baker, die mehrfach in der Umgegend von Asuncion massenhaft auftritt, *Wedelia brachycarpa* Baker, *Aspilia latissima* Malme, *Pterocaulon purpurascens* Malme und *Pt. subvirgatum* Malme. Unter den andinen Elementen der Compositen-Flora von Paraguay soll *Tessaria integrifolia* R. & P. besonders hervorgehoben werden, die am Ufer des Pilcomayo, unfern der Mündung, massenhaft vorkommt. Ihre Südgrenze haben in Paraguay unter anderen *Vernonia scabra* Pers., *Eupatorium macrophyllum* L., *E. megaphyllum* Baker, *Echinocephalum latifolium* Gardn. und *Senecio Benthami* Griseb., welche in Rio Grande do Sul nicht gefunden sind; der letztgenannte, der nach

Baker auch in Minas Geraes, nach Edwall in São Paulo gesammelt worden ist, ist mehrfach an den Ufern des Pilcomayo und des Paraguayflusses häufig, wo er an feuchten Lokalitäten das Gebüsch mit seinen lebhaft gefärbten Blüten schmückt. Die Nordgrenze haben in Paraguay unter anderen besonders in Rio Grande do Sul und den angrenzenden Teilen von Argentinien vorkommenden Pflanzen *Trixis ochroleuca* Hook. & Arn. und *Aspilia silphioides* (Hook. & Arn.).

Matto Grosso ist bis jetzt sehr wenig der Gegenstand botanischer Forschungen gewesen; seine Flora ist deswegen sehr unvollständig bekannt. Der grösste Teil des Staates wird, ohne Zweifel mit vollem Rechte, zu der südbrasilianischen Provinz und zwar zu der Oreas-Region gerechnet, und dies gilt von dem Gebiet — der Umgegend von Cuyabá — wo ich eine längere Zeit und zwar beinahe acht Monate zubrachte. Ein kleiner Strich am Alto Paraná soll nach Drude eine Vegetation haben, die in mehreren Hinsichten mit derjenigen der Dryas-Region übereinstimmt. Der nördliche Teil des Staates gehört zu der nordbrasilianischen Provinz — zu der Region der Najaden oder der Hylæa und der Region der Hamadryaden oder der Catinga, die wohl, wenigstens teilweise, zu dieser Provinz zu zählen ist. Im Südwesten grenzt Matto Grosso an Gran Chaco, und in pflanzengeographischer Hinsicht stimmt das zwischen dem Rio Mondego und dem Rio Apa gelegene Gebiet ohne Zweifel ganz beträchtlich mit der Region von *Bougainvillea* überein.

In der Umgegend von Cuyabá gehört zwar die Mehrzahl der Pflanzen zu den Oreaden. Schon längst ist jedoch bekannt, dass sich daselbst mehrere Hylæapflanzen finden, und nach meinen Beobachtungen dürfte die Zahl derselben grösser sein, als man gewöhnlich annimmt. Schon bei einer früheren Gelegenheit habe ich die Aufmerksamkeit darauf gelenkt, dass mehrere Polygalaceen, die in der Nähe von Cuyabá massenhaft wachsen, zu den Najaden zu zählen sind. Hier sollen einige wenige andere Hylæapflanzen erwähnt werden. Die kleine Rubiaceen-Gattung *Limnosipanea* ist in Matto Grosso durch drei Species vertreten: *L. Spruceana* Hook. fil., *L. Schomburgkii* Hook. fil. und eine neue, noch unbeschriebene. Die erstgenannte ist entschieden eine Hylæapflanze; sie war vorher aus Pará und von einem Fundorte in Goyaz bekannt. *L. Schomburgkii* Hook. fil., die in der Umgegend von Cuyabá an feuchten Lokalitäten häufig vorkommt, ist zwar als in São Paulo (von Riedel) angetroffen aufgeführt worden, da aber dieser Standort von den übrigen weit entfernt liegt, kommt er mir etwas zweifelhaft vor; Riedel bereiste bekanntlich auch Matto Grosso, und eine Etiquettenverwechselung scheint mir gar nicht ausgeschlossen zu sein. *Metastelma stenolobum* Dne. wurde sowohl vom Gymnasialoberlehrer Dr. C. Lindman als von mir in Sümpfen in der Nähe von Cuyabá gesammelt, wo sie gewiss nicht selten war; früher war diese Pflanze in Guyana und am Magdalenenstrome angetroffen worden. An den Bächen zwischen Cuyabá und São Jeronymo wächst mehrfach *Abuta concolor* Poepp., die wohl auch als eine Hylæapflanze anzusehen ist. Aus demselben pflanzengeographischen Gebiete stammen zweifellos auch die beiden Apocynaceen *Echites trifida* Jacq. und *Hæmadictyon angustifolium* Benth. var. *latifolium* Müll. Arg.; die erstgenannte ist jedoch an den Ufern des Paraguay bis nach Asuncion verbreitet. Dies sind nun einige Beispiele, die den Reichtum der Flora von Cuyabá an nordbrasilianischen Pflanzen bezeugen können; noch mehrere andere könnten leicht angeführt werden.

An Compositen ist Nordbrasilien bekanntlich sehr arm; es kann deshalb nicht befremden, dass die Repräsentanten dieser Familie in der Vegetation der Umgegend von Cuyabá, mit Ausnahme von *Vernonia remotiflora* Rich., *Mikania psilostachya* DC. var. *scabra* (DC.) Baker, *Eupatorium squalidum* DC. var. *Martiusii* (DC.) Baker, *Pectis jangadensis* Spenc. Moore und einigen wenigen anderen weit verbreiteten, meistens synanthropischen Species, fast ausschliesslich zu den Oreaden zu zählen sind.

Schon früher habe ich hervorgehoben, dass die Vegetation der westlichen Teile der Oreas-Region physiognomisch mit derjenigen der östlichen Teile zwar im allgemeinen übereinstimmt, dass aber die die Formationen konstituierenden Pflanzenspecies oft verschieden sind. Eine grosse Menge von Pflanzen, die in Minas Geraes häufig gesammelt worden sind, fehlt, soweit bis jetzt bekannt ist, in Matto Grosso und Goyaz; andrerseits kommen in diesen Staaten mehrere nicht selten vor, die in den grossen Sammlungen aus den westlichen Teilen der Hochebene nicht vorhanden sind. Dies ist der Fall mit mehreren Xyridaceen, z. B. *Xyris lacerata* Pohl, *X. Nilssonii* Malme und *X. stenocephala* Malme, mit den Asclepiadaceen *Barjonia cymosa* Fourn., *Ibatia lanosa* Fourn., *Nephradenia acerosa* Dne. und den brasilianischen Arten der Gattung *Astephanus*, mit mehreren knollentragenden Arten der Gattung *Cuphea*, z. B. *C. pterosperma* Koehne, *C. retrorsicapilla* Koehne und *C. enneanthera* Koehne nebst der prachtvollen *C. cuyabensis* Mart., mit den beiden eigentümlichen Schizæaceen *Aneimia millefolium* Gardn. und *A. tenuifolia* Presl, mit *Büttneria melastomæfolia* S:t Hil., *Calolisianthus acutangulus* (Mart.) Gilg und zahlreichen anderen Pflanzen, deren Tracht so eigentümlich oder deren Blüten so auffällig sind, dass sie gewiss der Aufmerksamkeit der vielen in Minas Geraes und den angrenzenden Teilen von São Paulo und Rio de Janeiro reisenden Botaniker nicht hätte entgehen können, wenn sie daselbst vorkämen.

Da die Früchte der Compositen leicht durch den Wind oder durch Tiere (epizoisch, sehr selten endozoisch) verbreitet werden, ist es leicht erklärlich, dass die meisten Oreas-Compositen über das ganze Gebiet verbreitet sind. Es fehlen jedoch nicht Repräsentanten dieser Familie, die auf Matto Grosso oder auf Matto Grosso und Goyaz beschränkt sind. Ausser den hier neubeschriebenen *Vernonia declivium* Malme, *V. oreophila* Malme, *V. rigescens* Malme, *Alomia Regnellii* Malme, *Eupatorium glandulosissimum* Malme, *Aster Regnellii* (Sch. Bip.) Baker **mattogrossensis* Malme, *Aspilia leucoglossa* Malme, *Isostigma foliosum* Malme, *Porophyllum macrolepideum* Malme, *Pectis stella* Malme und *Chuquiragua mattogrossensis* Malme, will ich einige durch ihre Tracht auffällige Arten hervorheben, und zwar *Vernonia chamæpeuces* Sch. Bip., *V. pulverulenta* Baker, *V. araneosa* Baker, mehrere Species der Gattung *Eremanthus*, *Eupatorium myriocephalum* Gardn., *E. subtruncatum* Gardn., *Kanimia palustris* Gardn., *Riencourtia tenuifolia* Gardn., *Oyedæa ovata* (Gardn.) Benth. und mehrere Arten der Gattung *Calea*, z. B. *C. ferruginea* Sch. Bip.

Die überwiegende Mehrzahl der Compositen wächst in den Cerrados, wo besonders im April und im Mai ein ganz beträchtlicher Teil der blühenden Kräuter, Halbsträucher oder Sträucher zu dieser Familie gehört. Eine bei weitem nicht so bedeutende Rolle spielen sie in den übrigens in der Umgegend von Cuyabá recht seltenen Campos limpos. An den übrigen Standorten (Wäldern, Sümpfen u. s. w.) finden sich, wie aus den in der folgenden Aufzählung mitgeteilten Angaben zu ersehen ist, nur wenige Compositen. An

den Ufern der Flüsse Rio Paraguay, Rio São Lourenço und Rio Cuyabá wachsen massenhaft Mikanien aus der Formengruppe *M. scandens* (L.) WILLD.; leider habe ich aber keine eingesammelt und nach Europa mitgebracht.

Über den Sprossbau und die Überwinterung einiger brasilianischen Compositen.

Die mehrjährigen Kräuter oder die Stauden, die in den Savannen der brasilianischen Hochebene vorkommen, zeichnen sich, wie WARMING in seiner bekannten Arbeit »Lagoa Santa» hervorgehoben hat, gewöhnlich durch einen kurzen, mehr oder weniger vertikalen unterirdischen Stamm und eine persistierende, harte, stark verholzte Hauptwurzel aus. Oft sind beide beträchtlich verdickt, wodurch ein sowohl aus Stammteilen als aus der Wurzel gebildeter Knollen entsteht. (Vergl. die von WARMING a. a. O. S. 194—197 gegebenen Abbildungen von *Baccharis humilis*, *Vernonia desertorum* und *Casselia chamædryfolia*, die in SCHIMPERS Pflanzengeographie reproduzierte Abbildung von *Gomphrena jubata* und meine Textfigur 1 *b*). In den meisten Fällen bildet die Wurzel (und der hypokotyle Stamm) die Hauptmasse des Knollens, z. B. bei *Vernonia desertorum* und *Casselia chamædryfolia;* in einigen tritt dieselbe aber in den Hintergrund, z. B. bei *Baccharis humilis* und *Baccharis rotundifolia*. Dergleichen harte, knollige, unterirdische Körper finden sich bei zahlreichen, besonders in den Campos limpos wachsenden Compositen sowohl in der Oreas-Region als auch in der Region der Napæen. Ausser den schon erwähnten *Vernonia desertorum* MART., *Baccharis humilis* SCH. BIP. und *Baccharis rotundifolia* SPRENG. seien nur einige Beispiele aufgeführt: *Vernonia*

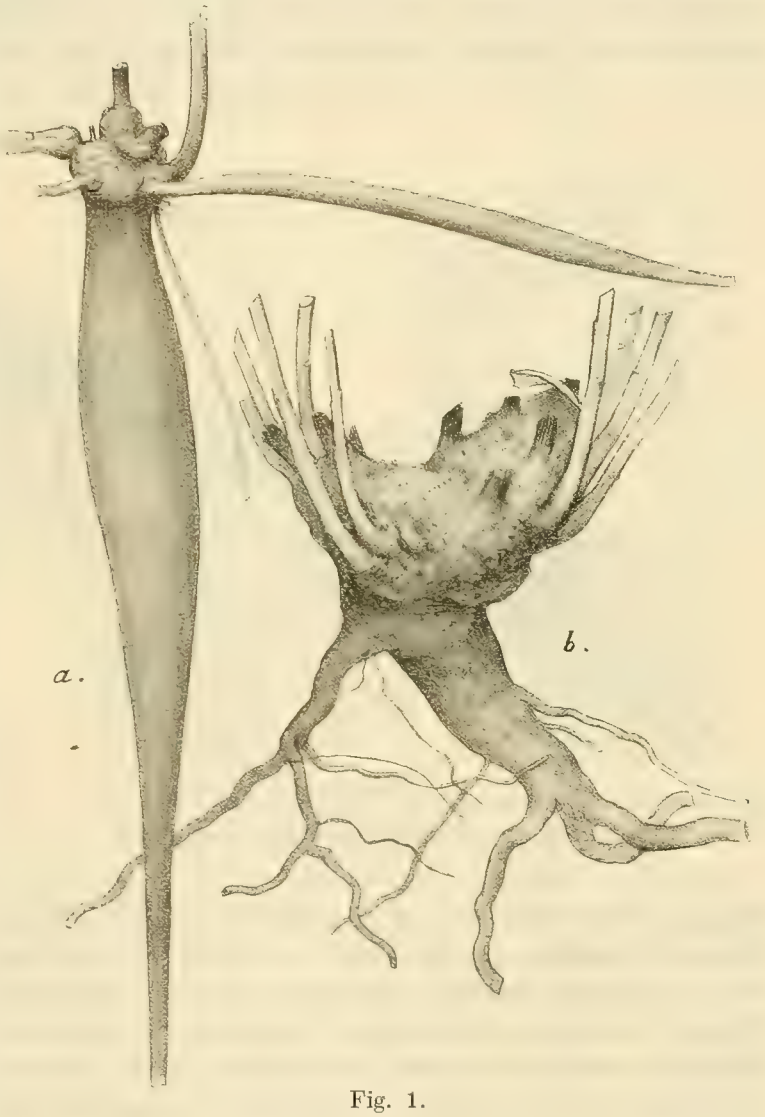

Fig. 1.

a. Viguiera pilosa BAKER; *b. Baccharis rotundifolia* SPRENG.

Sellowiana Less., *Baccharis tenuifolia* DC. var. *leptophylla* (DC.), *Riencourtia oblongifolia* Gardn., *Oyedæa ovata* Gardn. und *Isostigma peucedanifolium* (Spreng.) Less.

Sehr selten bleibt der Knollen weich und fleischig. Dies ist besonders der Fall bei *Calea uniflora* Less., die an etwas feuchten Lokalitäten in der Region der Napæen vorkommt, und weniger deutlich bei *Eupatorium oblongifolium* (Spreng.) Baker, welche Pflanze in demselben Gebiete, aber an trockenen Standorten wächst.

Am oberen Teile des Knollens entstehen nackte Knospen, entweder zahlreich, z. B. bei dem abgebildeten Exemplar von *Baccharis rotundifolia* Spreng., oder gewöhnlich nur wenige, unter denen nur eine oder ein paar zur weiteren Entwicklung gelangen; und nach längerer oder kürzerer Ruheperiode, öfters erst im Frühling, wachsen diese zu vegetativ-floralen, gewöhnlich wenig verzweigten Sprossen aus. In den allermeisten Fällen sind sämtliche Internodien verlängert und der ganze Spross mit assimilierenden Blättern versehen. (Vgl. *Vernonia desertorum* Mart. und *Baccharis humilis* Sch. Bip.); selten sind die unteren verkürzt, so dass eine Grundblattrosette entsteht, und dabei sind entweder keine anderen assimilierenden Blätter vorhanden (z. B. bei *Isostigma peucedanifolium* (Spreng.) Less. und *Inulopsis scaposa* (DC.) O. Hoffm.), oder es entwickeln sich noch wenige Stengelblätter, die jedoch kleiner sind, als die Grundblätter (z. B. bei *Vernonia Sellowiana* Less. und *Isostigma foliosum* Malme).

Fig. 2.

Eupatorium Candolleanum Hook. & Arn.

Dieser Typus (die knollentragenden Campos-Compositen) *überwintert* also *durch nackte, ungestielte Knospen; die Sprosse sind vegetativ-floral und* im allgemeinen *bis an die Inflorescenz beblättert; Grundblattrosette kommt nur sehr selten vor.*

Zahlreiche andere Campos-Compositen verhalten sich ebenso, nur dass weder die Wurzel noch der unterirdische Stammteil sich verdickt. Auch bei diesen kommen gewöhnlich nur wenige oder eine einzige Knospe zur weiteren Entwicklung (z. B. bei mehreren besonders in den Cerrados wachsenden Vernonien, Stevien und Eupatorien), seltener wachsen zahlreiche vegetativ-florale Sprosse aus (z. B. bei *Lucilia acutifolia* (Poir.) Cass., *Baccharis genistelloides* (Lam.) Pers. * *trimera* (DC.) Baker, *Porophyllum linifolium* (L.) DC. und *Pectis stella* Malme). Bisweilen perenniert bei einzelnen Individuen ein Teil des oberirdischen Stammes, so dass die Pflanze als ein Halbstrauch anzusehen ist (z. B. *Asteropsis macrocephala* Less. und *Achyrocline satureoides* (Lam.) DC.).

Bisweilen sind eine oder mehrere Wurzeln spindelförmig verdickt und fleischig (wahrscheinlich Wasserspeicher). Dies ist der Fall z. B. bei *Viguiera pilosa* BAKER (Fig. 1 *a*), die in Rio Grande do Sul an etwas feuchten Lokalitäten mit lockerem Boden wächst. Verdickte, aber gewöhnlich nicht spindelförmige sondern unregelmässig perlschnurförmige Wurzeln findet man auch bei *Jungia floribunda* LESS.

Hier sei auch *Eupatorium Candolleanum* HOOK. & ARN. erwähnt, welche Pflanze in Rio Grande do Sul gesellig und massenhaft an offenen, stark lehmigen Plätzen vorkommt, wo das Wasser sich nach stärkerem Regen ansammelt, längere Zeit stehen bleibt und die Entstehung einer Grasdecke verhindert. Sie überwintert durch Knospen oder kurze Sprosse, die sich teils am unteren Teile des Stammes, teils *normal an den Wurzeln* entwickeln.

Fig 3.

Eupatorium Tweedieanum HOOK. & ARN.

Das abgebildete Exemplar (Fig. 2) wurde im Mai gesammelt. Ausnahmsweise finden sich Wurzelsprosse auch bei der an ähnlichen Lokalitäten wachsenden *Pluchea quitoc* DC.

Nach WARMING sind Stauden mit unterirdischen Ausläufern sehr selten oder fehlen fast vollständig in den Campos oder Savannen bei Lagoa Santa.[1] Dasselbe ist nach meinen Beobachtungen der Fall in der Umgegend von Cuyabá. Etwas anders verhalten sich die Campos in Rio Grande do Sul, wenigstens was die Compositen betrifft. Schon bei den an trockenen Lokalitäten wachsenden *Eupatorium squarrulosum* HOOK. & ARN., *Solidago microglossa* DC., *Vernonia nudiflora* LESS. und *Eupatorium subhastatum* HOOK. & ARN. findet man unterirdische weissliche Ausläufer mit kleinen Niederblättern. Sie verlaufen eine längere oder kürzere Strecke horizontal, biegen sich zuletzt nach oben und entwickeln an der Spitze assimilierende Blätter (nicht selten schon im Herbste, was normal der Fall

[1] Unter den von WARMING erwähnten Compositen hat *Solidago microglossa* DC. unterirdische Ausläufer; sie wird jedoch mit ? als Campos-Pflanze aufgeführt und dürfte besser, gleich wie *Eupatorium pallescens* DC. (= *E. inulæfolium* H. B. K.), zu den synanthropischen Pflanzen zu zählen sein.

ist bei dem mit Grundblattrosette versehenen *Stenachenium campestre* Baker). Das von mehreren Ausläufergenerationen aufgebaute Rhizom ist ein Sympodium. Der aufrechte, oberirdische Teil des Sprosses ist vegetativ-floral und bis an die Inflorescenz beblättert

Fig. 4.

Trichocline macrocephala Less.

eine Ausnahme bildet gewissermassen *Stenachenium campestre* Baker, welche Pflanze in Bezug auf die Anordnung der Blätter an *Vernonia Sellowii* Less. erinnert. Bei den beiden letztgenannten, *Vernonia nudiflora* Less. und *Eupatorium subhastatum* Hook. & Arn., sind zwar die Ausläufer kurz, und ausser denselben sind auch ungestielte Knospen vorhanden; ihr geselliges Auftreten bezeugt jedoch, dass ihnen Ausläufer normal zukommen.

Noch zahlreicher, wenigstens was die Individuen betrifft, kommen Compositen mit langen, horizontalen unterirdischen Ausläufern vor an feuchten Standorten oder an Lokalitäten mit lockerem Boden: am Rande der grasbewachsenen Sümpfe oder in denselben selbst, z. B. *Eupatorium Tweedieanum* Hook. & Arn. (Fig. 3; das abgebildete Exemplar ist im Mai gesammelt) und *Eupatorium lætevirens* Hook. & Arn.; am Rande des Waldes, z. B. *Vernonia Tweedieana* Baker; in feuchten Capoeiras, z. B. *Eupatorium picturatum* Malme, und in der Nähe der menschlichen Wohnungen (synanthropisch), z. B. *Eupatorium inulæfolium* H. B. K. und *Solidago microglossa* DC.

Fig. 5.

Trixis ochroleuca (Cass.) Hook. & Arn.

Dieser zweite, oben kurz geschilderte Typus zeichnet sich also durch *unterirdische, mit Niederblättern versehene, horizontale Ausläufer* und ein sympodiales Rhizom aus; *der oberirdische, aufrechte Teil des Sprosses ist vegetativ-floral und bis an die Inflorescenz beblättert; eine Grundblattrosette kommt höchst selten vor.*

Im Zusammenhang mit den oben geschilderten seien zwei Compositen erwähnt, die in der Umgegend der Stadt Rio Grande wachsen, obgleich ich über deren Sprossbau nicht ganz im Reinen bin. Die eine, *Spilanthes leptophylla* DC., welche an recht trockenen Standorten vorkommt, ist mit langen Stolonen mit verlängerten Internodien versehen, die bald oberirdisch sind, bald im Sande begraben liegen und wenigstens oft assimilierende Blätter tragen. Aus den Blattachseln entwickeln sich im folgenden Jahre teils kurze und, wie es scheint, nur vegetative, teils längere, vegetativ-florale Sprosse, deren untere Internodien kurz sind, ohne dass jedoch eine wirkliche Grundblattrosette entstände. Der Aus-

läufer endigt in einen vegetativ-floralen Teil von demselben Bau wie die achselständigen vegetativ-floralen Sprosse. Die andere, *Eclipta elliptica* DC., welche an feuchten Lokalitäten wächst, hat ebenfalls beblätterte, oberirdische, aber viel kürzere Stolonen und scheint sich wie die vorige zu verhalten, nur dass ich keine nur vegetative Sprosse habe finden können. Ich hatte jedoch nur eine kurze Zeit, und zwar im Monat November, Gelegenheit, diese beiden Pflanzen zu beobachten.

Als Repräsentant eines dritten Typus kann die hier abgebildete *Trichocline macrocephala* Less. (Fig. 4) angeführt werden. *Die Hauptwurzel ist persistent*, in einigen Fällen hart und kaum merkbar verdickt, in anderen, z. B. bei der abgebildeten *Trichocline*, fleischig und mehr oder weniger verdickt. *Der Hauptspross ist vegetativ mit verkürzten Internodien*, so dass die Blätter eine (überwinternde) Rosette bilden. *Die Seitensprosse sind floral* (ohne assimilierende Blätter) und tragen öfters nur einen Blütenkorb. Derart gebaute Compositen sind in der Oreas-Region sehr selten und scheinen mehr einem gemässigten Klima angepasst zu sein. In Rio Grande kommen sie recht häufig vor. Ausser der schon genannten *Trichocline macrocephala* Less. seien erwähnt: *Trichocline foliosa* Hook. & Arn., *Tr. incana* (Lam.) Cass., *Chaptalia nutans* (L.) Hemsl., *Ch. integrifolia* (Cass.) Baker, *Ch. piloselloides* (Vahl) Baker und *Ch. exscapa* (Pers.) Baker. Wahrscheinlich gehört hierher auch *Hypochæris Gardneri* (Sch. Bip.) Baker.

Als eine Variante desselben Typus ist *Trixis ochroleuca* (Cass.) Hook. & Arn. (Fig. 5.) anzusehen. Ihre vielköpfigen Seitensprosse sind vegetativ-floral; die Blätter sind aber kleiner und haben eine andere Form, als die Grundblätter.[1] Mit derselben stimmt in Bezug auf den Sprossbau und die Überwinterung *Pamphalea Commersonii* Cass. (Taf. VII, Fig. 20) genau überein. Der Dimorphismus der Blätter ist jedoch noch grösser, und die Pflanze ist mit einem fast rundlichen, wahrscheinlich aus Stammteilen gebildeten, unterirdischen Knollen und mit spindelförmig verdickten Wurzeln versehen.

Bei einigen Eupatorien aus der Sektion *Heterolepis*, z. B. *Eupatorium lætevirens* Hook. & Arn. und *E. inulæfolium* H. B. K., habe ich zwei Sprosse in derselben Blattachsel gefunden. Der obere, der sich früher entwickelt, ist vegetativ-floral, der untere, der später zum Vorschein kommt, dagegen vegetativ. Bei *Eupatorium lætevirens* Hook. & Arn. hat letzterer kürzere, etwas breitere und stumpfere Blätter. Zwei Sprosse in derselben Blattachsel kommen bisweilen auch bei *Mikania apiifolia* DC. vor, entweder beide floral oder der obere, stärker entwickelte, vegetativ-floral.

Bei den windenden krautartigen Mikanien ist der Stamm monopodial; die Seitensprosse sind entweder floral, z. B. bei *Mikania *opifera* Mart., oder vegetativ-floral, z. B. bei *M. *periplocifolia* Hook. & Arn. und *M. *paraguayensis* Malme. Bei den rankenden Mutisien, *Mutisia campanulata* Less., *M. coccinea* S:t Hil. und *M. speciosa* (Ait.) Hook., dagegen ist der Blütenkorb endständig und der Stamm sympodial.

Unter den Sträuchern ist wegen ihres Sprossbaues besonders hervorzuheben die prachtvolle *Barnadesia rosea* Lindl., die in dieser Beziehung einigermassen an *Berberis vulgaris* L. erinnert. Die beblätterten Langtriebe endigen mit einem Blütenkorb. Bei den meisten Blättern sitzen je zwei Stacheln, deren morphologischer Wert mir noch unklar

[1] Ebenso verhalten sich, nach dem mir zur Verfügung stehenden Material zu urteilen, *Trixis brasiliensis* (L.) DC. und *Tr. pinnatifida* Less.

ist. In den Achseln der meisten Blätter entwickeln sich früh dicht beblätterte Kurztriebe oder, gegen die Spitze, vegetiv-florale Sprosse, welche oft auch Kurztriebe tragen. Die Blätter der Langtriebe fallen gewöhnlich bald weg. Meine Tagebuchsnotizen über diese eigentümliche Pflanze sind unvollständig, und das mitgebrachte getrocknete Material lässt keine genaue Untersuchung über den Sprossbau zu, weshalb ich über mehrere Fragen leider nicht ins Reine habe kommen können.

Was endlich die baumartigen Compositen betrifft, ist zu bemerken, dass die einzige in Rio Grande do Sul vorkommende, *Moquinia polymorpha* (LESS.) DC. var. *obtusifolia* (LESS.) DC., periodisch ihr Laub abwirft. Dasselbe ist ganz sicher der Fall bei der in Matto Grosso wachsenden *Piptocarpha rotundifolia* (LESS.) BAKER und wahrscheinlich auch bei *Eremanthus glomerulatus* LESS.

Über den Schauapparat einiger kleinblütigen Eupatorieen.

Der Schauapparat ist bekanntlich bei den einzelnen Gattungen und Arten der Compositen sehr verschieden. Bei einigen sind sämtliche Blüten des Körbchens verhältnismässig gross und auffällig gefärbt (z. B. bei den Cichorieen); bei anderen sind es die Randblüten, die durch ihre Grösse und Farbe die Insekten herbeilocken (z. B. bei den Mutisien und Trichoclinen); in mehreren Fällen haben die Hüllkelchschuppen oder die Hüllblätter diese Aufgabe übernommen; in noch anderen stehen die Köpfchen in grossen, dichten Blütenständen, welche von den Insekten leicht wahrgenommen werden, u. s. w.

Die Eupatorieen haben bekanntlich actinomorphe, gewöhnlich kleine Blüten; die Köpfchen erreichen im allgemeinen keine bedeutende Grösse und stehen ausserdem nicht selten in ziemlich lockeren Blütenständen. Von vorne herein könnte man deshalb berechtigt sein anzunehmen, dass in dieser Tribus oft Autogamie und Geitonogamie vorkommen. Letztere ist denn auch wahrscheinlich nicht selten, da die langen Griffelschenkel verschiedener Blüten desselben Körbchens sich vielfach berühren und kreuzen. Wie oft der Pollen auf diese Weise von der einen Blüte zur anderen transportiert wird, muss aber durch direkte Beobachtungen und Versuche ermittelt werden. So arm an Anlockungsmitteln für die Insekten, wie man sich oft vorstellt, sind jedoch die Eupatorieen nicht. In vielen Fällen duften die Blüten recht stark (z. B. bei mehreren Mikanien). In anderen tragen die lebhaft gefärbten Hüllkelchschuppen samt den Blüten dazu bei, einen guten Schauapparat herzustellen; in noch anderen wird durch die verschiedenen Teile der Blüten oder der Hüllblätter ein sehr auffälliger Farbenkontrast hervorgerufen.

Ein vorzügliches Beispiel des letztgenannten Falles liefert *Eupatorium hecatanthum* (DC.) BAKER; die Hüllblätter sind mit zottigen Anhängseln versehen, und diese sowohl als die Kronen sind rosenfarbig oder purpurrot, die Griffelschenkel dagegen gelb. Bei *Eupatorium Candolleanum* HOOK. & ARN. ist der Saum der Krone rosenfarbig, und gegen denselben stechen die weissen Griffelschenkel grell ab. Dasselbe ist der Fall bei *Eupa-*

torium vernoniopsis Sch. Bip. var. *roseoviolaceum* Malme, *E. ligulæfolium* Hook. & Arn. und mehreren anderen. Oft sind bei noch anderen Arten der Sektion *Heterolepis* die Kronen veilchenblau oder hellviolett und die Griffelschenkel weiss oder wenigstens weisslich. *Eupatorium Tweedieanum* Hook. & Arn. hat weisse Kronen und weisse Griffelschenkel, während die Antheren dunkelviolett sind.

Farbenkontrast zwischen den Blüten und den Hüllblättern, wenn die letzteren nicht grün sind, findet man recht selten. Als Beispiele seien genannt: *Eupatorium myriocephalum* Gardn. und *E. pictum* Gardn., bei welchen die Kronen (und die Griffelschenkel) veilchenblau, die Hüllblätter, besonders die Spitzen, hellviolett oder hell rosenfarbig, ferner auch *E. verbenaceum* DC. mit purpurroten Hüllblättern und dunkelvioletten Blüten. Sonst sind im allgemeinen bei den Species der Sektion *Osmia* ein grösserer oder kleinerer Teil der Hüllblätter, die Kronen und die Griffelschenkel von derselben Farbe, oft lebhaft gefärbt, und da die Köpfchen öfters grösser oder wenigstens länger sind, als bei der Sektion *Heterolepis*, werden sie eben dadurch leicht von den Insekten wahrgenommen, obgleich die Blüten keinen Farbenkontrast darbieten.

Dasselbe Resultat erreichen mehrere kleinköpfige, mit gefärbten Hüllblättern versehene *Heterolepis*-Arten, z. B. *Eupatorium nummularia* Hook. & Arn. und *E. bupleurifolium* DC., dadurch, dass die Köpfchen in dichten Blütenständen stehen.

Dies sind nur einige Beispiele, um zu zeigen, wie Farbenkontrast und grössere Sichtbarkeit der Blüten bei den brasilianischen Eupatorieen hervorgerufen werden. Wer Gelegenheit bekommt, sich längere Zeit in Brasilien aufzuhalten, ohne sich dabei zu bemühen, eine grosse Menge Meilen zurückzulegen, sondern wer längere Zeit in derselben Gegend bleibt und übrigens den in biologischer und morphologischer Hinsicht noch sehr wenig untersuchten Phanerogamen seine Aufmerksamkeit widmet, wird jedenfalls, sowohl was den Sprossbau und die Überwinterung als die Blütenbiologie betrifft, eine Fülle interessanter Thatsachen zu Tage fördern können.

Vernonieæ.

Centratherum Cass.

C. punctatum Cass. — Baker, Flora brasiliensis, fasc. LXII, p. 11.

Bahia: Rio Vermelho pr. urbem Bahia s. São Salvador (Juxta viam; loco aperto, arenoso-argillaceo. 18 $^{10}/_{10}$ 94 Malme 1800.).

Planta verisimiliter perennis.

Vernonia Schreb.

Nomen *Cacalia* Burm., ante reformatam a Linnæo nomenclaturam botanicam huic generi datum, restituere ineptum nobis videtur.

V. megapotamica Spreng. — Baker, l. c. pag. 27.

Rio Grande do Sul: Cachoeira (In campo aprico, arenoso, tenuiter graminoso. 18 $^{21}/_{2}$ 93. Malme 620.), Cruz Alta (In campo arenoso, aprico, sicco. 18 $^{12}/_{4}$ 93. Malme 762 B.).

In vicinitate oppidi Caldas mensibus Febr. et Mart. floret.

V. *eriocephala Malme n. subsp.

Ic. tab. nostr. I, fig. 1.

Differt a forma typica: foliis minoribus, marginibus distinctius revolutis; calathidiis sexfloris, in axillis foliorum solitariis v. binis, spicam laxam formantibus; involucris dense albido-tomentosis v. albido-sericeis, squamis oblongis v. lingulatis, obtusissimis (apice rotundatis v. truncatis), haud mucronatis, apicem versus ± purpureis; acheniis sericeis, pappo albido.

Paraguay: ad rivum Ŷ-aca (In campo arenoso. 18 $^{27}/_{1}$ 94. Anisits 461.).

Distincta species esse videtur; at specimina mihi obvia minus bona sunt, quamobrem ad interim ut subspeciem proposui.

Alia specimina, e territorio El Gran Chaco ab Hagenbeck reportata, in herbario Musei bot. Berolinensis obiter examinavinus.

V. chamæpeuces Sch. Bip. — Apud Baker, l. c. pag. 31.

Matto Grosso: Serra da Chapada, pr. São Jeronymo (In campo aperto apricoque, loco arenoso, graminoso. 18 3/6 94. Malme 1644.).

Frutex (v. suffrutex) usque ad 1 m. altus, parce ramosus. Ut *Vernonia ferruginea* Less., *Barnadesia rosea* Lindl., nonnullæ aliæ Compositæ tempore sicco floret.

Specimina originalia hujus speciei non vidimus, at specimina a nobis reportata ad descriptionem l. c. datam bene quadrant, quare determinatio sat certa. Specimina Riedeliana forsan in eadem regione, etiam ab oculatissimo illo peregrinatore visitata, collecta sint.

V. Sellowii Less. — Baker, l. c. pag. 32.

Rio Grande do Sul: Cachoeira (In campo aprico, arenoso. 18 22/2 93. Malme 636.). — Calathidia vulgo 3, squamis involucri subnudis, floribus violaceis.

V. araneosa Baker. — Baker, l. c. p. 32.

Matto Grosso: Buriti par. S:a Anna da Chapada (In campo aprico, arenoso, graminoso, nebulis sæpe humectato. 18 24/6 94. Malme 1744 B.).

V. onopordioides Baker. — Baker, l. c. pag. 36.

Matto Grosso: Arecá pr. Cuyabá (In »cerrado» minus denso, arenoso, alte graminoso. 18 1/4 94. Malme 1516.), Coxipó Mirim pr. Cuyabá (In »cerrado»; loco glareoso, sicco. 18 2/4 94. Malme 1516 B.).

Suffrutex usque ad 2 m. altus, sæpe arboris forma. Specimina 1516 B., loco sicciore collecta, a ceteris differunt ramis, foliis subtus involucrisque densius fulvescente-sericeis.

V. bardanoides Less. — Baker, l. c. pag. 36.

Matto Grosso: Santa Anna da Chapada (In »cerrado». 18 9/3 94. Malme 1460.).

V. pulverulenta Baker. — Baker, l. c. pag. 42.

Matto Grosso: Serra da Chapada, prope Bocca da Serra (Loco aperto, arenoso, graminoso, sicco. 18 22/6 94. Malme s. n. — Fere omnino deflorata.).

Specimina authentica hujus speciei non vidimus.

V. buddleiæfolia Mart. — Baker, l. c. pag. 43.

Matto Grosso: Santa Anna da Chapada (In »cerrado» minus denso. 18 9/3 93. Malme 1460 B.).

Foliis subtus minus dense albido-incanis recedit, ceterum cum speciminibus in civit. Minas Geraes a Claussen, Mosén, Riedel, Regnell, Widgren collectis bene congruit.

V. desertorum Mart. — Baker, l. c. pag. 48.

Minas Geraes: São João del Rey (In campo aprico, arenoso-glareoso, paulo ante flammis vexato. 18 31/8 92. Malme 18.).

V. brevifolia Less. — Baker, l. c. pag. 50.

Rio Grande do Sul: Porto Alegre (Parcissime in campis arenosis, apricis. 18 $^{21}/_{9}$—$^{3}/_{11}$ 92. Malme 86 & 86 *β*.).

Calathidiis paullulo majoribus foliisque latioribus a speciminibus Regnellianis a celeberr. Baker commemoratis differt et ad var. *ericifoliam* (Hook. & Arn.) Bak. paullulum accedit.

V. mollissima D. Don. — Baker, l. c. pag. 54.

Argentinæ civit. **Entrerios**: Diamante (leg. A. E. Kullberg).

Huc pertinet etiam Balansa N:o 875 (Paraguay: Caaguazu, in campis, Apr. 1876).

V. chamædrys Less. — Baker, l. c. pag. 57.

Rio Grande do Sul: inter col. Ijuhy et Cruz Alta (In campo arenoso, aprico. 18 $^{11}/_{4}$ 93. Malme 764.).

E diario nostro pluribi in Campos da Cima da Serra occurrit.

Huc pertinet etiam Balansa 966. (»L'Assomption, sur les collines incultes. Arbuste très-rameux, atteignant un mètre de hauteur. Fleurs rouges.»)

V. remotiflora Rich. — Baker, l. c. pag. 69.

Matto Grosso: Cuyabá (In »cerrado», imprimis locis subhumidis, terra ± denudata. 18 $^{7}/_{2}$ 94. Malme 1366 B. — 18 $^{28}/_{3}$ 94. Malme 1498. — 18 $^{6}/_{4}$ 94. Malme 1518 B*β*.), Coxipó Mirim pr. Cuyabá (18 $^{2}/_{4}$ 94. Malme 1518 B.).

Planta annua, ± synanthropica (secundum vias etc. crescens), in vicinitate oppidi Cuyabá haud rara.

V. echitifolia Mart. — Baker, l. c. pag. 71.

Matto Grosso: Guia pr. Cuyabá (Loco aperto, humido-uliginoso, in consortio Cyperacearum, Utriculariarum etc. 18 $^{13}/_{5}$ 94. Malme 1618.).

Flores albi. — Huc pertinet Balansa 878 (Caaguazu, »dans les marais. Mars 1876»).

In vicinitate oppidi Caldas floret mensibus Februario et Martio.

V. squarrosa Less. — Baker, l. c. pag. 75.

Rio Grande do Sul: Piratiny pr. Pelotas (Gregatim in campo aprico, arenoso. 18 $^{12}/_{12}$ 92. Malme 464.).

Planta a nobis reportata sistit var. foliis angustioribus, circiter 2 mm. latis, et indumento involucri minus denso recedentem; omnino eadem esse videtur ac *V. pseudosquarrosa* Hieron. (in Englers bot. Jahrb. Band XXII (1897), pag. 685.).

V. glabrata Less. — Baker, l. c. pag. 76.

Rio Grande do Sul: Santo Angelo pr. Cachoeira (In campo subhumido, graminoso. 18 $^{10}/_{2}$ 93. Malme 546.).

In vicinitate oppidi Caldas mensibus Jan. et Febr. floret.

V. declivium Malme n. sp.

Ic. tab. nostr. I fig. 2.

Lepidaploa axilliflora, herbacea, usque ad 1 m. alta. *Caulis* ramosus,, usque ad apicem foliatus, teres, striatus, glaber v. scabriusculus, inferne usque ad 4 mm. crassus, internodiis vulgo 3—4 cm. longis. *Folia* breviter petiolata, petiolo 3—5 mm. longo, supra et subtus viridia, late lanceolata v. anguste elliptica, 12—15 cm. longa, (3—)3,5—5 cm. lata, basi acuta et in petiolum sæpe decurrentia, apice acuta v. acuminata, subintegerrima v. parce denticulata, supra verrucis parvis scabra, subtus pilis brevibus sat parcis scabriuscula, nervis venisque supra immersis, subtus manifeste emersis; nervis secundariis angulo 60°—90° insidentibus, arcuatis, marginem versus junctis. *Inflorescentia* scorpioideo-cymosa, ampla, sat laxa, ramis sæpissime simplicibus, scorpioideis, pleiocephalis; bracteis foliaceis, (4—)5—7(—8) cm. longis, eadem forma ac folia at sæpe pro rata paullulo angustioribus, calathidia multoties superantibus. *Calathidia* sessilia, solitaria, raro gemina, 35—40-flora. *Involucra* urceolato-campanulata, circiter 8 mm. longa, circiter 6 mm. crassa; squamæ 5—6-seriatæ, sæpe purpurascentes, adpressæ v. inferiores squarrosæ, infimæ brevissimæ, triangulari-lanceolatæ, longe cuspidato-mucronatæ, mediæ ovatæ, 4—5 mm. longæ, 2—2,5 mm. latæ, longiuscule v. sat breviter squarrose acuminato-mucronatæ, superiores oblongo-lanceolatæ, circiter 7 mm. longæ, 2—2,5 mm. latæ, acutæ, summæ (intimæ) lineari-lanceolatæ, circiter 1,5 mm. latæ, acutiusculæ (rarius subobtusæ), præsertim mediæ sat dense ciliatæ, et supra (intus) et subtus (extus) pilis mollibus parce tomentosæ v. subsericeæ. *Corolla* circiter 6 mm. longa, tubo 2,5—3 mm. longo, cylindraceo; lobis limbi violacei v. violaceo-purpurei circiter 2 mm. longis, lanceolato-linearibus, acutiusculis, ipso apice papillis hyalinis ornatis, ceterum glabris. *Antheræ* subinclusæ, 2 mm. longæ. *Achenia* subcylindracea v. anguste turbinata, manifeste costata, inter costas parce sericea, 3—4 mm. longa, straminea, pappi albidi subæquilongi v. paullulo longioris setis interioribus exteriora multoties superantibus, caducis.

Matto Grosso: Serra da Chapada (Inter frutices secundum vias, in declivibus montis. 18 2/6 94. Malme 1656.).

Affinis est *V. sericeæ* Rich., abs qua foliorum latiorum minus longe acuminatorum indumento, calathidiis minoribus, acheniis minus dense sericeis, pappo brevi facile est distincta.

V. oreophila Malme n. sp.

Ic.: tab. nostr. I fig. 3.

Lepidaploa axilliflora, fruticosa, circiter 30 cm. alta, valde ramosa, trunco vulgo tortuoso, ramis sæpissime curvatis, cortice tenui, parce suberoso, obscuro. *Rami* juniores ± erecti, teretes, holosericei v. dense sericeo-pubescentes, albidi v. griseo-fulvescentes, usque ad apicem dense foliati. *Folia* breviter petiolata, petiolo vulgo 2—3 mm. longo, ovata v. elliptica, rarius ovato-oblonga, basi rotundata v. rarius in petiolum paullulum decurrentia, apice obtusa v. rarius subacuta, media (maxima) 2,5—3 cm. longa, 13—16(—18) mm. lata, omnia integerrima, supra viridia, sat dense sericeo-pubescentia glandulisque sessilibus, parvis (siccis micantibus), copiosissimis ornata, subtus albida, holosericea, parcius glandulosa, odores Hyptidis (aliarumque Labiatarum) exhalantia, nervis subtus paullulum emersis;

nervis secundariis utroque latere vulgo 4—5. *Inflorescentia* scorpioideo-cymosa, contracta, oligocephala, bracteis foliaceis, eadem forma ac folia at sæpe minoribus, calathidia vulgo superantibus. *Calathidia* sessilia, solitaria, circiter 25-flora. *Involucra* urceolato-campanulata, vulgo 7—8 mm. longa, circiter 6 mm. crassa; squamæ 4—5-seriatæ, adpressæ, apicem versus sæpe violascentes, lanceolatæ, acutæ, infimæ 2 mm. longæ, circiter 0,66 mm. latæ, mediæ 4—5 mm. longæ, 1,5 mm. latæ, superiores (interiores) circiter 7 mm. longæ, 1,5—1,66 mm. latæ, omnes dorso sericeo-pubescentes, margine ciliatæ. *Corolla* circiter 7 mm. longa, tubo glabro circiter 5 mm. longo, sursum sensim dilatato; lobis limbi coerulei circiter 2 mm. longis, vix 0,5 mm. latis, sublinearibus, acutis, apicem versus dorso glandulis sessilibus, hyalinis, copiosis ornatis, ceterum glabris. *Antheræ* generis, paullulum exsertæ, circiter 4 mm. longæ. *Rami styli* subulati, dense hirtelli, diu (an persistenter?) tubo antherarum inclusi. *Achenia* turbinata, brevia, circiter 1,5 mm. longa, longe denseque albido-sericea; pappus albidus, setis interioribus 6 mm. longis, rigidis, caducis, exterioribus 1—1,5 mm. longis, sat latis.

Matto Grosso: Serra da Chapada, pr. São Jeronymo (Supra rupes et in fissuris rupium; locis apricis, ventosis. 18 $^{18}/_{6}$ 94. MALME 1700.).

Arcte affinis *V. nitenti* GARDN. (BAKER, l. c. pag. 78), quæ non nisi e descriptione mihi est nota; forsan sit ejus varietas. Differt foliis multo minoribus, pro rata paullulo latioribus, calathidiis minoribus, floribus paucioribus etc.

V. rigescens MALME n. sp.

IC.: tab. nostr. I fig. 4.

Lepidaploa axilliflora, herbacea (v. suffruticosa), usque ad 1 m. alta. *Caulis* subsimplex, usque ad apicem foliatus, teres, striatus v. leviter sulcatus, glaber, præsertim apicem versus sæpe purpurascens, inferne usque ad 5 mm. crassus, internodiis vulgo 2—3 cm. longis. *Folia* sessilia, utrinque viridia v. subtus paullulum glaucescentia, rigida, linearia v. anguste lanceolata, sæpe canaliculata, integerrima, margine haud revoluta, media (10—)11—13(—14) cm. longa, 6—7 mm. lata, omnia utroque apice acuta, supra et subtus glabra, nervis venisque utrinque exsculptis tuberculisque parvis scabridulis. *Inflorescentia* scorpioideo-cymosa, laxa, ampla, ramis sæpissime simplicibus, scorpioideis, vulgo pleiocephalis; bracteis foliaceis, vulgo linearibus, angustissimis, calathidia multoties superantibus. *Calathidia* sessilia, solitaria, rarius gemina, circiter 15-flora. *Involucra* basi ovoidea, medio constrictula, 8—10 mm. longa, 3—4 mm. crassa; squamæ circiter 5-seriatæ, omnes adpressæ v. infimæ squarrosulæ, infimæ lanceolatæ-triangulares vix 0,5 mm. latæ, mediæ ovatæ 3,5—4 mm. longæ, 1,5—2(—2,5) mm. latæ, breviter mucronatæ, superiores (interiores) lanceolatæ 7—9 mm. longæ, 1,5—2 mm. latæ, acutæ v. acuminatæ, omnes apicem versus purpurascentes, præsertim mediæ margine longe et sat dense ciliatæ, dorso pilis p. p. maxima brevibus et basi incrassata nigris, adpressis parce vestitæ. *Corolla* circiter 8 mm. longa, tubo circiter 3,5 mm. longo; lobis limbi violaceo-purpurei circiter 3 mm. longis, anguste lanceolatis v. sublinearibus, acutis, apicem versus dorso pilis brevibus, atris parcissime ornatis. *Antheræ* exsertæ, circiter 4 mm. longæ, basi profunde (0,5 mm.) sagittatæ, apice longe appendiculatæ. *Achenia* 2—2,5 mm. longa, turbinata, manifeste

costata, dense sericea; pappi sordidi setæ interiores 5—7 mm. longæ, exterioribus multoties longiores.

Matto Grosso: Santa Anna da Chapada (In »cerrado» minus denso. 18 $^{7}/_{3}$ 94. MALME 1462.).

A *V. rubricauli* H. B., cui sine dubio est affinis, jam foliis rigidis, subtus viridibus glabrisque facillime est distincta. — In *V. graminifolia* GARDN., quam non nisi e descriptione cognovimus, folia sunt multo longiora, calathidia majora, 35—40 flora, squamæ interiores involucri ligulatæ, obtusæ.

V. rubricaulis H. B. — BAKER, l. c. pag. 79.

Matto Grosso: Cuyabá (In margine paludis alte graminosæ. 18 $^{16}/_{4}$ 94. MALME s. n.).

V. rubricaulis H. B. var. australis HIERON.
HIERONYMUS in ENGLERS bot. Jahrb. Band XXII (1897), pag. 688.

Rio Grande do Sul: Santo Angelo pr. Cachoeira (In campo subhumido, alte graminoso. 18 $^{10}/_{2}$ 93. MALME 552.).

V. obtusata LESS. — BAKER, l. c. pag. 87 (ex p.).

Matto Grosso: Santa Anna da Chapada (In »cerrado» minus denso. 18 $^{9}/_{3}$ 94. MALME 1462 B.), Arecá pr. Cuyabá (In »cerrado» minus denso, arenoso, alte graminoso. 18 $^{1}/_{4}$ 94. MALME 1520.).

Corollæ dilute coeruleæ v. subalbidæ. — Specimina in Santa Anna da Chapada collecta cum speciminibus Sellowianis omnino congruunt; specimina ex Areca reportata calathidiis ad axillas foliorum sæpe ternis et tum paullulo minoribus recedunt.

V. lævigata MART. apud DC. — DC. Prodr. tom V, pag. 56.

Matto Grosso: Coxipó Mirim pr. Cuyabá (In »cerrado» minus denso, glareoso, sicco. 18 $^{2}/_{4}$ 94. MALME 1518.).

Et foliis angustioribus, integerrimis (haud serrato-dentatis) et calathidiis paullulo majoribus (involucro circiter 8 mm. longo) obscurioribusque et pappo sordido a *V. obtusata* LESS. bene distincta esse videtur.

V. obscura LESS. — BAKER, l. c. pag. 89.

Matto Grosso: Cuyabá (18 $^{27}/_{3}$ 94. MALME s. n.).
Specimen reportatum juvenile, incompletum, haud certe determinandum.

V. obovata LESS. — BAKER, l. c. pag. 91.

Matto Grosso: Cuyabá (In »cerrado» minus denso, loco arenoso-glareoso. 18 $^{21}/_{11}$ 93. MALME 1122 C. — Fere omnino deflorata.).
In vicinitate oppidi Caldas mensibus Octobr. et Novembr. floret.

V. flexuosa SIMS. — BAKER, l. c. pag. 93.

Rio Grande do Sul: Porto Alegre (In collibus apricis, siccis. 18 1/11 92. MALME 240.), Pelotas (In campo arenoso, aprico. 18 9/12 92. MALME 440.).

Omnia specimina reportata ad var. *microcephalam* HIERON., l. c. pag. 693 pertinent.

V. platensis (SPRENG.) LESS. — BAKER, l. c. pag. 95.

Rio Grande do Sul: Santo Angelo pr. Cachoeira (In campo subhumido, alte graminoso. 18 10/2 93. MALME 550.).

V. Tweedieana BAKER. — BAKER, l. c. pag. 99.

Rio Grande do Sul: colonia Ijuhy (In »capoeira» nova, secundum viam. 18 8/4 93. MALME 760.), Rincão dos Valles pr. Cruz Alta (In campo arenoso, alte graminoso, nec non in margine silvulæ. 18 20/4 93. MALME 792 C.), Santa Maria (In campo subhumido, graminoso. 18 30/4 93. MALME 760 *β*.).

Huc pertinet BALANSA 751 (Asuncion, »dans les terrains vagues». 18 2/4 74.).

Hibernat stolonibus hypogæis.

V. scabra PERS. — BAKER, l. c. pag. 100.

Paraguay: Asuncion (Gregatim in pascuis. 18 21/7 93. MALME 846.).

Frutex usque ad 4 m. altus, trunco recto, haud multum ramoso, corollis albis, rarius roseolis, fragrantibus, ramis styli roseo-violaceis.

Huc pertinet etiam BALANSA 808 (Asuncion, »dans les bas-fonds argileux, un peu humides. Juillet 1874. Tiges de 1 m. 50. Fleurs blanchâtres exhalant une odeur rappelant celle de la vanille.»).

V. scorpioides PERS. — BAKER, l. c. pag. 101.

Paraguay: Asuncion (In fructicetis, in pascuis, secundum vias etc.; locis sat siccis 18 13/7—25/7 93. MALME 832 B.). secundum fluv. Pilcomayo territorii Gran Chaco (In ripa fluvii. 18 7/9 93. MALME 832 C.).

Huc pertinet BALANSA 879 *a* (Asuncion, »dans les haies». 18 /6 74.).

E. diario nostro haud rara occurrit in ripa fluminis Cuyabá inter Corumba et oppidum Cuyabá.

V. ferruginea LESS. — BAKER, l. c. pag. 102.

Matto Grosso: Cuyabá (Gregatim in »cerrado»; loco arenoso-glareoso, sicco. 18 9/7 94. MALME 1760 B.).

E. diario nostro est copiosissima in marginibus silvularum secundum fluvium Cuyabá.

Flores odoratissimi.

Specimina a nobis reportata ad *V. polycephalam* DC. (cui pappus achenii albidus) pertinere videntur, quam a *V. ferruginea* LESS. distinguere nequimus.

V. membranacea GARDN. — BAKER, l. c. pag. 105 (*V. ruficoma* SCHLECHT.).

Matto Grosso: Cuyabá (In »cerrado» minus denso; locis glareosis, siccis. 18 7/5 94. MALME 1606.).

Frutex arborescens usque ad 2 m. altus, ramis erecto-patentibus, cortice tenui lævigato, corollis florum albis eximie fragrantibus.

V. nitidula LESS. — BAKER, l. c. pag. 115.

Paraguay: prope Concepcion (In campo graminoso, sat sicco, ad marginem silvulæ ripæ flum. Paraguay. 18 17/9 93. MALME 952.).

V. florida GARDN. (= *V. nitidula* LESS. var. *florida* (GARDN.) BAKER, l. c. pag. 115) et foliis latioribus et calathidiis majoribus, involucris in pedicella longius decurrentibus (nec non distributione geographica) sat recedit et melius ut propria species habenda.

V. nudiflora LESS. — BAKER, l. c. pag. 117.

Rio Grande do Sul: Santo Angelo pr. Cachoeira (In campo subhumido, graminoso. 18 10/2 93. MALME 548.).

In viciniis oppidi Cachoeira copiosissima et gregatim in campo sicco apricoque occurrit; etiam in viciniis oppidi Santa Maria nec non pluribi in campis inter Silveira Martins et Cruz Alta est observata.

Hibernat stolonibus hypogæis, subaphyllis, sat tenuibus.

Piptocarpha R. BR.

P. rotundifolia (LESS.) BAKER. — BAKER, l. c. pag. 125.

Matto Grosso: Santa Anna da Chapada (In »cerrado». 18 22/2 94. MALME 1416 B.).

Arbor 2—4 m. alta, trunco ramisque flexuosis tortuosisque, cortice crasso, suberoso, rimoso.

Stilpnopappus MART.

S. speciosus (LESS.) BAKER. — BAKER, l. c. pag. 138.

Matto Grosso: Cuyabá (In »cerrado» minus denso; loco glareoso, sicco. 18 27/3 94. MALME 1490. — 18 10/4 94. MALME 1490*.).

Frutex usque ad 1 1/2 m. altus, parce ramosus, ramis ± erectis.

Eremanthus LESS.

E. glomerulatus LESS. — BAKER, l. c. pag. 162.

Matto Grosso: pluribi in vicinitate oppidi Cuyabá. Specimina collecta sunt inter Guia et Cuyabá (In »cerrado» minus denso; loco sicco. 18 11/5 94. MALME 1616.).

Arbor campestris usque ad 3 m. alta, trunco ramisque flexuosis tortuosisque, cortice crasso, suberoso, rimoso, intus nigrescente. Flores dilute coerulei v. albi. »Casca preta» (cortex niger) incolarum propter corticem intus nigrescentem ad oculos curandos adhibitum.

E. exsuccus (DC.) BAKER. — BAKER, l. c. pag. 166.

Matto Grosso: Serra da Chapada, pr. Bocca da Serra (In campo arenoso-glareoso, graminoso, nebulis sæpe humectato. 18 5/6 94. MALME 1708 B. — Flores nondum bene evoluti.), Buriti par. Santa Anna da Chapada (18 21/6 94. Malme 1708.).

Suffrutex usque ad 1 m. altus, plerumque simplex, sæpe monocephalus. Flores albi v. dilute coerulei.

Elephantopus L.

E. scaber L. var. tomentosus (L.) SCH. BIP. — BAKER, l. c. pag. 173.

Rio Grande do Sul: pluribi; specimina reportata sunt e Santo Angelo pr. Cachoeira (In hortis etc., rarius in campis. 18 20/1 93. MALME 512.); **Paraguay**: Asuncion (18 19/1 94. ANISITS 343.).

E. ripariús GARDN. — BAKER, l. c. pag. 174.

Matto Grosso: Cuyabá (In ripa rivi; loco arenoso, umbroso. 18 23/5 94. Malme 1632.). Flores violacei—lilacini.

E. angustifolius SW. — BAKER, l. c. pag. 176.

Rio Grande do Sul: Santo Angelo pr. Cachoeira (In campo subhumido, alte graminoso. 18 10/1 93. MALME 498.).

Pluribi et in Rio Grande do Sul, ex. gr. inter Cruz Alta et Silveira Martins nec non in viciniis oppidi Santa Maria, et in Paraguay, ex. gr. Colonia Risso pr. Rio Apa, est observata.

Eupatorieæ.

Gymnocoronis DC.

G. spilanthoides (D. DON.) DC. — BAKER, in Flora brasiliensis, Fasc. LXIX, pag. 183.

Matto Grosso: Corumbá (In lacuna cum flum. Paraguay communicante. 18 24/7 94. MALME 1768.). — Rami vegetativi sæpe apicem versus foliis sparsis (nec oppositis).

Huc pertinet BALANSA 866 *a* (»Bords marécageux de Rio Paraguay près de l'Assomption». 18 23/5 74.).

Adenostemma FORST.

A. viscosum FORST. var. triangulare (DC.) BAKER. — BAKER, l. c. pag. 185.

Rio Grande do Sul: Silveira Martins pr. Santa Maria (In ripa uliginosa rivuli. 18 13/3 93. MALME 702.).

Etiam alibi in civitate Rio Grande do Sul observavimus, ex. gr. in col. Ijuhy et in viciniis oppidi Cruz Alta.

Alomia H. B. K.

A. Regnellii Malme n. sp.

Ic.: tab. nostr. II fig. 5.

Herba perennis, usque ad 30 cm. alta, rhizomate brevi, adscendente v. subhorizontali. *Caulis* subsimplex, erectus v. basi adscendens, usque ad apicem foliatus, teres, pilis mollibus, patentissimis sat parce vestitus glandulisque ± longis, sat copiosis viscosus, basi usque ad 2 mm. crassus, internodiis vulgo 1—2 cm. longis. *Folia* tenuia, (superioribus exceptis) opposita, longe petiolata, petiolo 1,5—3 cm. longo (laminam longitudine sæpe æquante), æque ac caulis piloso viscosoque, triangulato-deltoidea v. rarius late ovata, in speciminibus luxuriantibus usque ad 4(—4,5) cm. longa, usque ad 3,5(—4) cm. lata, in speciminibus macrioribus sæpe vix 2 cm. longa, 1,5 cm. lata, apice acuta, inciso-crenata, et supra et subtus viridia, supra glabra v. parce viscosa, subtus glandulis gracilibus viscosa et præsertim ad nervos pilis mollibus parce ornata, margine glandulis brevibus, gracilibus ciliata. *Inflorescentia* cymosa, laxa, pedunculis pedicellisque foliis (bracteis) ovato-lanceolatis v. lanceolatis, longiuscule v. breviter petiolatis, profunde at parce serratis v. subintegerrimis suffultis; pedicellis gracilibus, sat dense glandulosis. *Calathidia* circiter 5 mm. longa, multiflora (circiter 40-flora), homogama, receptaculo plano, glabro, nudo. *Involucra* campanulata; squamæ 20—25, nonullæ (5—7) breviores, ovato-lanceolatæ v. lanceolatæ, ceteræ subæquales, lineari-oblanceolatæ, circiter 5 mm. longæ, omnes circiter 0,8 mm. latæ, acutæ, virides, dorso glandulis pilisque gracilibus parce vestitæ, margine præsertim apicem versus pilis vulgo simplicibus sat dense cilitatæ. *Corolla* alba v. coerulescens circiter 3 mm. longa, tubo sensim dilatato (basi circiter 0,5 mm., fauce circiter 1 mm. crasso), extus intusque glabro; lobis limbi brevibus (circiter 0,75 mm. longis), triangulari-ovatis (0,4—0,5 mm. latis), subobtusis, intus glabris, extus subglabris v. pilis paucis munitis. *Stamina* generis, inclusa, filamentis circiter 0,5 mm. longis, antheris æquilongis. *Rami styli* manifeste clavati, apices loborum limbi paullulum (circiter 0,5 mm.) superantes. *Achenia* circiter 2,5 mm. longa, sublinearia v. anguste turbinata, pentagona et quinquecostata, nigra, nitentia, glabra v. basi et sub apice pilis nonnullis brevibus, demum evanescentibus munita.

Matto Grosso: Serra da Chapada, Buriti (In fissuris rupium præruptarum, præsertim subumbrosis. 18 $^{15}/_{6}$ 94. Malme 1678.).

Specierum brasiliensium nulli arcte affinis; similitudinem quandam præbet cum *A. ageratoide* H. B. K. mexicana, abs qua tamen forma serraturaque foliorum, indumento involucri, forma tubi corollæ etc. facillime distinguitur.

Stevia Cav.

S. satureifolia (Lam.) Sch. Bip. var. **multiaristata** (Spreng.) Baker. — Baker, l. c. p. 208.

Rio Grande do Sul: São Martinho pr. Santa Maria (In colle lapidoso, sicco, aprico, 18 $^{26}/_{4}$ 93. Malme 804.).

A ceteris *St. satureifoliæ* formis varietatibusve et foliis latioribus et indumento glanduloso recedit; forsan melius pro propria specie sit habenda. *Steviarum* genus (præsertim species in Brasilia terrisque adjacentibus occurrentes) valde polymorphum et locis natalibus sedulo examinandum.

S. laxa Hook. & Arn. — Baker, l. c. pag. 209 (*Stevia satureifolia* var. *laxa* (Hook. & Arn.) Baker); Hieronymus in Englers bot. Jahrb. Band XXII (1897), pag. 738.

Var. **curtula** Malme n. var.

Herba perennis v. suffrutex 20—35 cm. alta, rhizomate brevissimo, basi vulgo simplex, rarius parce ramosa. *Caulis* teres, erectus, inferne hispido-villosus (pilis longis, albis, articulatis), parce pubescens glandulosusque, superne epilosus, minute at sat dense glandulosus, parce—parcissime pubescens, vulgo præsertim apicem versus purpurascens. *Folia* omnia opposita v. summa alterna, inferiora sat conferta, internodiis 0,5—1 cm. longis, cetera sursum magis magisque distantia decrescentiaque, internodiis 2—3 cm. longis, sessilia, oblanceolata v. obovata, acuta v. acutiuscula, majora 20—25(—30) mm. longa, 8—10 (rarissime —15) mm. lata, basi cuneata integerrimaque, ceterum distincte crenato-serrata, dense glanduloso-punctata, subtus parce, supra parcissime et præsertim marginem versus pilis longis, albis, articulatis vestita, manifeste pinnato-trinervia, nervis subtus emersis. *Inflorescentia* terminalis, laxissime paniculata, pedicellis calathidiorum vulgo 1,5—2 cm. longis, gracilibus, purpurascentibus, epilosis, dense minuteque glandulosis. *Squamæ involucri* circiter 6 mm. longæ, circiter 1 mm. latæ, lineari-oblongæ, acutæ v. subobtusæ (apice deltoideæ), margine subhyalinæ, dorso virides v. purpurascentes, sat dense minuteque glandulosæ. *Corollæ* albæ, ex involucro longe exsertæ. *Achenia* manifeste costata, parce glandulosa, 2,5—3 mm. longa; pappus aristis 15—20, ferrugineo-purpurascentibus, circiter 6 mm. longis formatus.

Rio Grande do Sul: inter Silveira Martins et Cruz Alta (In campo arenoso aprico. 18 $^{25}/_{3}$ 93. Malme 726 B.), Cruz Alta (18 $^{12}/_{4}$ 93. Malme 726. Bβ. Fere omnino deflorata.).

A *St. laxa* Hook. & Arn., cui arcte affinis est, foliis paullulo latioribus, involucris multo brevioribus, corollis albis;

a *St. satureifolia* (Lam.) Sch. Bip. var. *multiaristata* (Spreng.) Baker foliis fere omnibus oppositis, multo latioribus, magis distantibus et involucris brevioribus;

a *St. oxylæna* DC. et *St. cinerascente* Sch. Bip. jam indumento;

a *St. entreriensi* Hieron. involucris brevioribus, squamarum involucri forma et pappo ± purpurascente differt.

S. cruziana Malme n. sp.

Ic.: tab. nostr. II fig. 6.

Herba perennis usque ad 0,75 m. alta, parce ramosa v. simplex, rhizomate brevissimo, crasso. *Caulis* erectus, usque ad 3 mm. crassus, teres, indistincte sulcatus, usque ad apicem foliatus, basi glabratus, ceterum pilis albis, articulatis, ± crispulis, sat brevibus et glandulis minutis dense vestitus. *Folia* omnia opposita, sat distantia, internodiis vulgo 3—5 cm. longis, petiolata, petiolo 10—15 mm. longo, ovata v. rhomboidali-ovata, acuta,

majora (4—)5—6(—6,5) cm. longa, (2,5—)3—4(—5) cm. lata, omnia basi sæpe late cuneata, integerrima et in petiolum vulgo decurrentia, ceterum grosse crenata v. crenato-serrata, sat dense glanduloso-punctata, subtus cinerascentia, ad nervos sat dense, ceterum parce pilis mollibus, albis, articulatis vestita, margine pilis brevibus glandulisque minutis parce ciliata, supra pilis brevibus sparsis ornata, nervis secundariis infimis bene evolutis, nervo primario subæqualibus ramosisque trinervia, venis sat conspicuis. *Inflorescentia* universalis sat ampla laxaque, partialibus ± congestis densisque, pedicellis calathidiorum vulgo 1—3 (rarius —5) mm. longis sat gracilibus, pilis brevibus, ± crispulis glandulisque sat minutis dense vestitis. *Calathidia* circiter 10 mm. longa; *squamæ involucri* lineari-lanceolatæ, (7,5—)8 —9 mm. longæ, 1—1,25 mm. latæ, acutæ (apice lanceolatæ), margine subhyalinæ, ceterum virides v. stramineo-virides, dorso pilis brevibus, mollibus, sat densis glandulisque curtis, sat parcis vestitæ. *Corollæ* albidæ, exsertæ, circiter 8 mm. longæ, tubi extus glabri v. parcissime glandulosi parte dimidia inferiore cylindracea, superiore sensim ampliata; laciniis limbi 1,5—2 mm. longis oblongo-ovatis, acutiusculis, extus pilis glandulisque curtis parce ornatis. *Rami styli* longe exserti, subfiliformes. *Achenia* circiter 3 mm. longa, manifeste pentagona v. quinquecostata, costis scabriusculis, inter costas glaberrima v. parcissime glandulosa; pappus ex aristis 15—20 sordide albidis v. paullulum ferrugineis, circiter 5 mm. longis formatus.

Rio Grande do Sul: Cruz Alta (Inter frutices; loco sat sicco. 18 17/4 93. MALME 786.).

St. aristatæ D. DON, mihi non nisi e descriptione notæ, affinis, abs qua jam foliis pro rata latioribus, longius petiolatis, supra pilis ornatis differt. In *St. veronicæ* DC. inflorescentiæ laxæ, folia breviter petiolata v. subsessilia, ad basin longe angustata etc.

Mikania WILLD.

Nomen *Willoughbya* NECK., jam diu oblivioni datum, resuscitare vix est necessarium.

M. officinalis MART. — BAKER, l. c. pag. 221.

Matto Grosso: Santa Anna da Chapada (Loco aperto, arenoso, humido. 18 28/2 94. MALME 1440 B.), Serra de Curupira (In campis apricis jam paullo uliginosis. 18 17/2 94. LINDMAN s. n.)

M. ternifolia DC. — BAKER, l. c. pag. 222.

Rio Grande do Sul: inter Silveira Martins et Cruz Alta (In campo arenoso, aprico. 18 24/3 93. MALME 726.), Cruz Alta (18 13/4 93. MALME 726 γ.).

Foliis minus profunde pinnatifidis a speciminibus Sellowianis recedit, at certe specifice non diversa.

M. involucrata HOOK. & ARN. — BAKER, l. c. pag. 239 (*M. bracteosa* DC.).

Rio Grande do Sul: Hamburgerberg (Frutex alte volubilis in fruticetis et arboribus, locis ± humidis. 18 20/10 92. MALME 202. Jam p. parte deflorata.).

Folia verisimiliter ad hanc speciem pertinentia præterea e Silveira Martins reportavimus.

M. chlorolepis Baker. — Baker, l. c. pag. 247.

Rio Grande do Sul: colonia Ijuhy (Inter frutices; loco sat aperto, in silva. 18 $^{29}/_{3}$ 93. Malme 734.).

Cum speciminibus originalibus Bakerianis in Herb. Regnell. asservatis omnino congruit.

Verisimiliter huc pertinet etiam specimen sterile e Silveira Martins a cl. C. Lindman reportatum.

M. scandens (L.) Willd. ***periplocifolia** (Hook. & Arn.). — Baker, l. c. pag. 249 (pro var.).

Ic. tab. nostr. III fig. 7.

Rio Grande do Sul: Quinta pr. oppidum Rio Grande (In fruticeto subhumido. 18 $^{6}/_{12}$ 92. Malme 434.); **Paraguay**: territor. El Gran Chaco, in adspectu urbis Asuncion (Cum *Ipomœa fistulosa*, loco paludoso. 18 $^{29}/_{8}$ 93. Malme 898 B.), El Chaco, in ripa fluvii Paraguay (ad truncos *Salicis* alte volutans. 18 $^{25}/_{9}$ 93. Lindman 2151.).

Foliorum forma, ramis florigeris sæpissime foliatis, inflorescentiis contractis densisque, calathidiis parvis, involucri circiter 2,5 mm. longi squama infima s. bractea subulata, ceteras sæpissime superante facile distincta.

In speciminibus e Paraguay reportatis, ad quæ icones in tab. nostra III datæ confectæ sunt, caulis glaberrimus est, sat indistincte costatus, sæpe paullulum purpurascens; folia sunt sat parce glanduloso-punctata, et supra et subtus subglabra; squamæ involucri subglabræ, parce glanduloso-punctatæ, margine parce ciliatæ, exteriores acutiusculæ, interiores obtusæ; flores ex involucro longe exserti; achenia inter costas glanduloso-punctata, pappi albi setæ 25—30.

Specimina in Rio Grande do Sul collecta differunt foliis minoribus, dense glanduloso-punctatis, et supra et subtus pilis brevibus, ± adpressis, parcis pubescentibus, lobis basalibus magis divergentibus patentissimisque; squamis involucri, præsertim exterioribus, distinctius pubescentibus et densius glanduloso-punctatis.

Var. **intermedia** Malme n. var.

Caulis teres, leviter costatus, glanduloso-punctatus, pilis mollibus albis sat dense vestitus. Folia longe petiolata (petiolo circiter 3 cm. longo, indumento caulis), fere eadem forma ac in *M. *periplocifolia*, dense glanduloso-punctata, et supra et subtus pilis brevibus sat parcis hirtella. Rami florigeri sæpissime foliati. Inflorescentia contracta densaque, pedicellis calathidiorum vulgo circiter 1 mm. longis. Calathidia circiter 6 mm. longa; involucri circiter 4 mm. longi squama infima s. bractea lanceolato-subulata, pilis albis sat parce vestita, ceteræ acutæ v. interiores nonnumquam obtusiusculæ, dorso glanduloso-punctatæ pilisque albis, mollibus parce ornatæ; cetera *M. *periplocifoliæ*.

Paraguay: Colonia Risso pr. Rio Apa (Inter gramina; loco humido. 18 $^{13}/_{10}$ 93. Malme 1090 E.).

Præsertim indumento et involucro longiore a forma typica recedit; aliquantulum ad **cynanchifoliam* (Baker) (Baker, l. c. pag. 249. *M. scandens* var. *cynanchifolia* Hook. & Arn. mss.) vergit.

M. scandens (L.) WILLD. ***opifera** MART. — BAKER, l. c. pag. 249 (*M. scandens* var. *umbellifera* (GARDN.) saltem p. p.).

IC.: tab. nostr. III fig. 8.

Paraguay: Asuncion ($18\,^{2}/_{4}\,74$. BALANSA 762.).

Foliis late ovato-cordatis, sinu profundo, angusto; inflorescentiis sat densis, umbelliformibus; calathidiis parvis, circiter 5,5 mm. longis; involucri 4,5—5 mm. longi squama infima seu bractea lanceolata, ceteris multo breviore dignota.

Caulis speciminum a BALANSA collectorum teres, striatus, pilis brevibus, patentissimis v. ± recurvatis parce vestitus; folia longe petiolata (petiolo laminæ subæquilongo, indumento caulis), breviter acuminata, undulato-crenata, dense glanduloso-punctata, supra glabra, subtus præsertim ad nervos pilis parcis ornata; inflorescentiæ axillares, subefoliatæ, foliis longiores, sat densæ, pedicellis calathidiorum vulgo 1—2 mm. longis, subglabris; squamæ involucri parcissime glanduloso-punctatæ, apicem versus margine dense ciliatæ, acutæ v. interiores nonnumquam subobtusæ; corollæ ex involucro haud multum exsertæ; achenia *M. *periplocifoliæ*, pappo ± rufescente.

Huic formæ simillima sunt specimina e Rio de Janeiro a FREYREISS et WIDGREN et e Santos a MOSÉN (In ripa amnis Buturoca. $18\,^{25}/_{3}\,75$. N:o 3647.) reportata. Differunt caule, petiolis, pedunculis pedicellisque glabris; foliis acutis, sinu lato, multo minus profundo; squamis involucri glabris, subeciliatis, distinctius acutis. Ad descriptionem *M. umbelliferæ* GARDN. in HOOKERS Lond. Journ. of Bot. IV (1845) pag. 119 datam bene quadrant; nominanda var. *umbellifera* (GARDN.) MALME.

M. scandens (L.) WILLD. ***paraguayensis** MALME n. subsp.

IC.: tab. nostr. IV fig. 10.

Caule tomentoso; foliis late ovato-cordatis, sinu minus profundo, lato, repando-dentatis, longe acuminatis; ramis florigeris sæpissime foliatis; inflorescentiis contractis densisque; calathidiis parvis, circiter 5 mm. longis; involucri circiter 2 mm. longi squama infima s. bractea lanceolata, acuminata, sat dense pilosa, ceteras multum superante dignota.

Caulis subteres, striatus v. costulatus, parcissime glanduloso-punctatus, pilis brevibus mollibus, albis pubescens v. tomentosus; *folia* longe petiolata, petiolo vulgo circiter 5 cm. longo, in sinu late cuneata, sat dense — parce glanduloso-punctata, et supra et subtus pilis brevibus præsertim ad nervos sat parce ornata, majora usque ad 9 cm. longa, usque ad 7 cm. lata, lobis basalibus rotundatis, superiora minora, angustiora, subtriangulata; *inflorescentia M. *periplocifoliæ*, pedicellis calathidiorum vulgo circiter 1 mm. longis, pubescentibus; *squamæ involucri* parce glanduloso-puuctatæ, late albo-hyalino-marginatæ, exteriores acutæ v. longius acuminatæ, dorso pilis albis, mollibus sat dense ornatæ, interiores obtusæ v. brevissime acuminatæ, subglabræ; *corollæ* longe ex involucro exsertæ; *achenia M. *periplocifoliæ*, pappo albo.

Paraguay: territor. El Gran Chaco, Rio s. Riacho Negro (Inter frutices ripæ fluvii. $18\,^{15}/_{9}\,93$. MALME 946.).

A *M. *periplocifolia* indumento, bractea involucri lata foliisque latioribus etc. differt.

M. laxa DC. — BAKER, l. c. pag. 250. ***euryanthela** MALME n. subsp.

Ic.: tab. nostr. III fig. 9.

Caulis teres, striatus, glaberrimus, hinc inde verruculosus (rami juniores tenuiter fugaciterque puberuli). *Folia* obscure viridia (ut herba tota), longe petiolata, petiolo 2,5—3 cm. longo, glaberrimo, late cordato-triangulata, sinu minus profundo, latissimo, v. subtriangulata, acuta v. paullulum acuminata, subintegerrima, supra et subtus glabra (juniora fugaciter tenuissimeque puberula). *Inflorescentia* foliata, thyrsoidea, ampla, usque ad 20 cm. longa, usque ad 10 cm. lata, laxa, pedicellis calathidiorum vulgo circiter 5 mm. longis, glabris. *Calathidia* 8—9 mm. longa. *Involucri* circiter 5 mm. longi *squama* infima s. bractea late lanceolata, acuta, ceteris multo brevior; ceteræ glabræ, apicem versus margine minute ciliatæ, anguste hyalino-marginatæ, exteriores subacutæ, interiores obtusæ. *Corollæ* ex involucro longe exsertæ, lobis limbi pro rata longis, circiter 1,5 mm. longis, late lanceolatis, acutis, patentibus. *Achenia* (speciminum reportatorum immatura) glabra, circiter 3 mm. longa, pappo circiter 5 mm. longo, e pilis circiter 30 formato, albo (dein rufescente?).

Paraguay: Areguá pr. Asuncion (Inter frutices; loco sat aperto, humido. 18 $^{20}/_{8}$ 93. MALME 882.).

Corollæ foliorumque forma cum *M. laxa* DC. bene congruit; ceteris notis, ex. gr. inflorescentia thyrsoidea valde recedit. Forsan pro propria specie sit habenda.

Specimina habitu subsimilia in herbariis nomine *M. thunbergiæfoliæ* GARDN. salutata vidimus, quæ species e descriptione diversissima.

M. cordifolia (L. fil.) WILLD. — BAKER, l. c. pag. 253 (excl. syn. nonnullis).

Rio Grande do Sul: Santo Angelo pr. Cachoeira (Inter gramineas altas campi subhumidi nec non in »capoeiras». 18 $^{11}/_{2}$ 93. MALME 562.).

Indumento calathidiisque multo longioribus (in speciminibus supra commemoratis 10 mm. longis), involucri (7—8 mm. longi) squamis omnibus acutis, pro rata angustioribus a *M. scandente* (L.) WILLD. et affinibus facile dignoscitur.

M. apiifolia DC. — BAKER, l. c. pag. 262.

Rio Grande do Sul: colonia Ijuhy (Inter frutices; loco sat aperto in silva. 18 $^{30}/_{3}$ 93. MALME 732.).

In vicinitate oppidi Caldas, ubi a WIDGREN (anno 1845) et a REGNELL (N:o III: 1590) collecta est, mense Aprili floret.

M. psilostachya DC. var. **scabra** (DC.) BAKER. — BAKER, l. c. pag. 265.

Matto Grosso: Cuyabá (In »cerrado» sat denso prope oppidum. 18 $^{7}/_{5}$—$^{23}/_{5}$ 94. MALME 1608.).

Eupatorium L.

E. conyzoides VAHL *α* **Maximiliani** (DC.) BAKER. — BAKER, l. c. pag. 277.

Matto Grosso: Cuyabá (In »cerrado»; loco sicco. 18 $^{3}/_{5}$ 94. MALME 1508 B.).
I vicinitate oppidi Caldas floret mensibus (Aprili) Majo—Julio.

E. foliatum (SCH. BIP.) HIERON. — HIERONYMUS in ENGLERS bot. Jahrb. Band XXII (1897), pag. 748.

Rio Grande do Sul: Silveira Martins pr. Santa Maria (Imprimis in »capoeiras», locis ± apertis. 18 $^{15}/_{3}$ 93. MALME 708.), colonia Ijuhy (Ejusmodi loco. 18 $^{30}/_{3}$ 93. MALME 708 B.).

E. squalidum DC. — BAKER, l. c. pag. 281.

Matto Grosso: Cuyabá (In »cerrado» pr. oppidum. 18 $^{27}/_{3}$ 94. MALME 1488 B. — 18 $^{13}/_{4}$ 94. MALME s. n. — 18 $^{7}/_{5}$ 94. MALME s. n.).

Var. **tomentosum** (SCH. BIP.) BAKER. — BAKER, l. c. pag. 282.

Matto Grosso: Cuyabá (In »cerrado»; locis glareosis, siccis. 18 $^{20}/_{4}$ 94. MALME 1566. — 18 $^{7}/_{5}$ 94. MALME 1566 B.).

Var. **Martiusii** (DC.) BAKER. — BAKER, l. c. pag. 282.

Matto Grosso: Coxipó (igreja) pr. Cuyabá (In »cerrado». 18 $^{27}/_{4}$ 94. MALME s. n.).
Varietates forsan melius pro speciebus distinctis sint habendæ.

E. squarrulosum HOOK. & ARN. — BAKER, l. c. pag. 284 (*E. liatrideum* DC.).

Rio Grande do Sul: Cachoeira (In campo aprico, arenoso, inter Myrtaceas fruticosas, quas »Araça do campo» vocant incolæ. 18 $^{16}/_{2}$ 93. MALME 588. — 18 $^{11}/_{5}$ 93. MALME 588*. Omnino defloratum.).

Hibernat stolonibus hypogæis, tenuibus, subhorizontalibus.

E. lævigatum LAM. — BAKER, l. c. pag. 286.

Rio Grande do Sul: Cruz Alta (In campo; locis terra fere denudata, aqua pluviali aliquantulum stagnante. 18 $^{12-17}/_{4}$ 93. MALME 766.); **Matto Grosso**: Cuyabá (In »cerrado»; imprimis locis subhumidis. 18 $^{13}/_{4}$ 94. MALME 1542.).

Inter vulgatissimas Compositas et civitat. Rio Grande do Sul et civitat. Matto Grosso censendum.
In vicinitate oppidi Caldas mensibus Martio et Aprili floret.

E. myriocephalum GARDN. — BAKER, l. c. pag. 289.

Matto Grosso: Cuyabá (In »cerrado»; locis subhumidis. 18 $^{8}/_{5}$ 94. MALME 1598 C*.).
Specimina originalia hujus speciei non vidimus, quare determinatio haud omnino est certa.

E. densiflorum MORONG (Annals N. Y. Acad. Sci. VII, Dec. 1892, pag. 136.).

Paraguay: Asuncion, Recoleta. (18 13/2 94. ANISITS 330.)

Huc pertinet BALANSA 933 (Asuncion, »dans le champs incultes». 18 7/4 74.).

Specimina originalia hujus speciei non vidimus, at specimina in Herb. Regnell. asservata cum descriptione l. c. data plane congruunt.

BALANSA 937 *a* (»Bords de l'Arroyo Jejui, au nord de Caaguazu. Avril 1876».) ad *E. ivæfolium* L. (BAKER, l. c. pag. 290) pertinet.

E. pictum GARDN. — BAKER, l. c. pag. 291.

Matto Grosso: Cuyabá (In »cerrado» sat denso. 18 3/5 94. MALME 1598 C.).

Specimina reportata nimis juvenilia et haud certe determinanda; ceterum non nisi unicum speciminulum authenticum valde mancum vidimus.

E. asperrimum SCH. BIP. — BAKER, l. c. pag. 292.

Matto Grosso: Cuyabá (In »cerrado» sat denso; imprimis locis arenosis, subhumidis. 18 3/5 94. MALME 1598.).

Suffrutex v. herba perennis 1 m. altus, floribus violaceis.

E. subtruncatum GARDN. — BAKER, l. c. pag. 293.

Matto Grosso: Cuyabá (In »cerrado» sat denso. 18 8/5 94. MALME 1614.).

Specimina authentica hujus speciei non vidimus.

E. subhastatum HOOK. & ARN. — BAKER, l. c. pag. 294 (*E. bartsiæfolium* DC.).

Rio Grande do Sul: Cachoeira (In campo arenoso, aprico, inter Myrtaceas et Vernonias. 18 20/2 93. MALME 612.).

Huc pertinet BALANSA 952 (Caaguazu, »dans les campos». 18 7/3 76.).

E. bracteatum HOOK. & ARN. — BAKER, l. c. pag. 298 [*E. tozziæfolium* DC. var. *bracteatum* (HOOK. & ARN.)].

Rio Grande do Sul: Santo Angelo pr. Cachoeira (In campo subhumido, graminoso. 18 30/1 93. MALME 526.).

E. caaguazuense HIERON. — HIERONYMUS in ENGLERS bot. Jahrb. Band XXII (1897) pag. 760.

Rio Grande do Sul: Santo Angelo pr. Cachoeira (In campo subhumido graminoso. 18 30/1 93. MALME 528.).

E. lupulinum BAKER. — BAKER, l. c. pag. 301.

Matto Grosso: Cuyabá (In »cerrado» sat denso; loco arenoso-glareoso. 18 10/4 94. MALME 1528.).

E. oxychlænum DC. — BAKER, l. c. pag. 314 (*E. amygdalinum* LAM. var. *oxychlœnum* (DC.) BAKER.).

Matto Grosso: ad radices montis Serra da Chapada nec non ad Coxipó Mirim pr. Cuyabá (In campo aperto, arenoso-glareoso, sat graminoso. 18 $^{30}/_{6}$ 94. MALME 1756.).

Indumento et ab *E. amygdalino* LAM. et a specie sequente valde recedit.

E. glandulosissimum MALME n. sp.

Herba perennis usque ad 0,5 m. alta, rhizomate crasso, brevissimo. *Caulis* teres, erectus, simplex, usque ad apicem foliatus, glandulis curtis pilisque brevibus, albis, mollibus dense vestitus. *Folia* distantia, internodiis vulgo 3—5 cm. longis, erecto-patentia, apicem caulis versus decrescentia, sessilia, oblanceolata, obtusa basi, longe cuneata, majora circiter 7 cm. longa, 1,5—2 cm. lata, omnia integerrima v. indistincte repando-dentata, supra glandulis sessilibus densissime, pilis brevibus, mollibus sat dense — parce vestita, subtus sat dense glandulosa, pilis brevibus, mollibus, densis tomentosa, margine sæpe scabriuscula, nervis secundariis utroque latere vulgo circiter 9, arcuatis junctisque; venis distinctis, reticulatis. *Inflorescentia* terminalis, corymbosa, circiter 5 cm. lata, sat densa, pedicellis calathidiorum vulgo 2—4 mm. longis, glandulosis, tomentosis. *Calathidia* 20—25-flora, circiter 7 mm. longa; *involucri* campanulati *squamæ* circiter 30, apice roseæ v. roseo-purpurascentes, parce glandulosæ, pilis mollibus, albis præsertim apice sat dense vestitæ, valde inæquilongæ, circiter 5-seriatæ, infimæ anguste lanceolatæ, ceteræ lineares, 0,5—0,75 mm. latæ, trinerves, acutæ v. acuminatæ, superiores, circiter 4 mm. longæ. *Corollæ* roseæ, ex involucro manifeste exsertæ, circiter 5 mm. longæ, tubi gracilis parte dimidia inferiore cylindrica, superiore sensim paullulum dilatata; lobis s. dentibus limbi lanceolato-triangulatis, vix 0,5 mm. longis, erectis, extus (dorso) glandulis brevipetiolatis parce ornatis. *Stamina* inclusa. *Rami styli* haud multum (vix 1 mm.) exserti, erecti, filiformes. *Achenia* in speciminibus reportatis valde immatura circiter 1,5 mm. longa, pilis adpressis parce sericea.

Matto Grosso: Serra da Chapada, Buriti (In campo aprico, arenoso, graminoso, nebulis sæpe humefacto. 18 $^{24}/_{6}$ 94. MALME 1744.).

E. oxychlæno DC. valde affine; differt calathidiis paullo minoribus et præsertim indumento dense glanduloso.

E. Tweedieanum HOOK. & ARN. — BAKER, l. c. pag. 319 (*E. steviæfolium* DC. var. *erigeroides* (DC.) BAKER.).

Rio Grande do Sul: Cruz Alta (In campo; locis humidis, ± graminosis. 18 $^{13}/_{4}$ 93. MALME 780.), Santa Maria (In campo subhumido, sat graminoso. 18 $^{30}/_{4}$ 93. MALME 806 B.), Cachoeira (18 $^{11}/_{5}$ 93. MALME 780*. Fere omnino defloratum.).

Flores albi, antheræ violaceæ. Hibernat stolonibus hypogæis subhorizontalibus.

Aeque ac sequens pluribi in civit. Rio Grande do Sul.

Huc pertinet BALANSA 736 (Paraguari, »dans les pâturages». 18 $^{24}/_{4}$ 75.).

E. lætevirens HOOK. & ARN. — BAKER, l. c. pag. 319 (*E. steviæfolium* DC. var. *lætevirens* (HOOK. & ARN.) BAKER.).

Rio Grande do Sul: Cruz Alta (In campo; locis paludosis, graminosis. 18 $^{12}/_{4}$—$^{17}/_{4}$ 93. MALME 774.).

E. tremulum HOOK. & ARN. — BAKER, l. c. pag. 322 (*E. dendroides* var. *xylophylloides* (DC.) BAKER).

Rio Grande do Sul: pr. oppidum Cruz Alta (In ripa rivuli campi uliginosa, graminosa. 18 $^{22}/_{4}$ 93. MALME 796.).

E. megaphyllum BAKER. — BAKER, l. c. pag. 322.

Paraguay: Paraguari (In silva minus densa montis Cerro Negro. 18 $^{1}/_{8}$ 93. MALME 864.).

Frutex arborescens, parce ramosus, usque ad 4 m. altus, floribus albis.

E. picturatum MALME n. sp.

Ic.: tab. nostr. IV fig. 11.

E (Heterolepis) herbaceum, perenne, usque ad 1,5 m. altum, rhizomate horizontali, ± elongato, sympodiali, stolonibus longis, hypogæis, subaphyllis, horizontalibus hibernans. *Caulis* teres, lævis, glaberrimus, erectus, sat ramosus, apicem versus sæpe purpurascens, usque ad inflorescentiam foliatus. *Folia* opposita, distantia (internodiis 6—12 cm. longis), alato-petiolata (petiolis foliorum majorum usque ad 2 cm. longis), anguste ovato-deltoidea v. ovato-rhomboidalia, acuta v. rarius acuminata, basi late cuneata integerrima, ceterum grosse serrata, et supra et subtus viridia et ad nervos parcissime pilosa, ceterum glabra, margine pilis rigidis, adpressis, sat densis ciliata, nervis secundariis utroque latere 4—5, inferioribus validioribus, angulo 35—40°, ceteris angulo 45—50° insidentibus; venis densissimis, haud prominentibus. *Inflorescentia* terminalis, corymbosa, usque ad 10 cm. lata, densa, pedicellis valde inæquilongis, (æque ac pedunculis) pubescentibus. *Calathidia* 7—8 mm. longa, 12—15-flora; *involucri* anguste campanulati *squamæ* 15—20, dorso violaceæ, vulgo striis 3 albis ornatæ, late albo-hyalino-marginatæ, valde inæquilongæ, 3—4-seriatæ, obtusæ, infimæ 1—1,5 mm. longæ, ovatæ, dorso levissime puberulæ, margine breviter denseque ciliatæ, mediæ 2—3 mm. longæ, 1—1,25 mm. latæ, ovales, dorso glabræ, margine ciliatæ, superiores lineari-lingulatæ, usque ad 5 mm. longæ, vix 1 mm. latæ, eciliatæ. *Corollæ* roseo-violaceæ v. violaceæ, nonnihil ex involucro exsertæ, tubo e basi angustissima sensim paullulum dilatato, glaberrimo; lobis seu dentibus limbi brevissimis, late triangulatis, circiter 0,3 mm. longis, paullulo latioribus, acutis, erectis, dorso glabris. *Stamina* inclusa. *Rami styli* albi v. dilute violacei, longissime exserti, filiformes v. leviter clavati. *Achenia* circiter 1,2 mm. longa, nigricantia, glaberrima, nitida, pappi albidi, circiter 4 mm. longi setis circiter 30, manifeste ciliatis.

Rio Grande do Sul: colonia Ijuhy (In »capoeira» sat nova. 18 $^{3}/_{4}$ 93. MALME 752.).

Habitu, foliorum forma, stolonibus hypogæis etc. *E. inulæfolium* H. B. K. in memoriam revocat species nostra, eique sine dubio sat affinis est. Differt glabritie, florum numero, squamarum involucri colore etc.

In clavi p. p. artificiali celeberrimi BAKER ad Heterolepides floribus in unoquoque calathidio 10—20 instructas referendum.

E. prasiifolium (GRISEB.) HIERON. — HIERONYMUS in ENGLERS bot. Jahrb. Band XXII (1897), pag. 768.

Argentinæ civit. **Entrerios**: Diamante (leg. A. KULLBERG 1895).

Specimina reportata ad formam pertinent, quam GRISEBACH (Symb. ad. Flor. argent. (1879), pag. 171) *E. pycnocephalum* nuncupat.

E. inulæfolium H. B. K. (ex HIERONYMUS, l. c. pag. 765). — BAKER, l. c. pag. 324 (*E. pallescens* DC.).

Rio Grande do Sul: Silveira Martins pr. Santa Maria (Ruderalis, in pascuis, in »roças» etc. 18 $^{22}/_{8}$ 93. MALME 720.). E diario nostro in Rio Grande pluribi nec non ad Asuncion reipublicæ Paraguay copiose occurrit.

E. ligulæfolium HOOK. & ARN. — BAKER, l. c. pag. 327 (*E. gnidioides* DC.).

Rio Grande do Sul: Porto Alegre (In campo; locis arenosis, siccis, ventosis. 18 $^{31}/_{5}$ 93. MALME 822.).

Frutex usque ad 1 m. altus. Flores roseo-violacei, ramis stylorum albis.

E. serratum SPRENG. — BAKER, l. c. pag. 328.

Rio Grande do Sul: Silveira Martins pr. Santa Maria (In »capoeira» minus densa; loco subhumido. 18 $^{28}/_{2}$ 93. MALME 668.).

Foliis subtus viridibus, subcalvis ad var. *alpestre* (GARDN.) BAKER aliquantulum accedit.

Forsan melius sit nuncupandum *E. comptoniæfolium* DC.

E. nummularia HOOK. & ARN. — BAKER, l. c. pag. 330.

Rio Grande do Sul: Santo Angelo pr. Cachoeira (In campo humido nec non ad marginem silvulæ (»capão»). 18 $^{11}/_{2}$ 93. MALME 564.).

Frutex usque ad 1 m. altus, parce ramosus, ramis erectis.

E. bupleurifolium DC. var. **asclepiadeum** (DC.) BAKER. — BAKER, l. c. pag. 333.

Rio Grande do Sul: Hamburgerberg (Locis paludosis, apertis, alte graminosis. 18 $^{25}/_{10}$ 92. MALME 236.).

E. oblongifolium (SPRENG.) BAKER. — BAKER, l. c. pag. 333.

Rio Grande do Sul: inter Silveira Martins et Cruz Alta (In campo arenoso, aprico. 18 $^{24}/_{3}$ 93. MALME 724 B.), Cruz Alta (18 $^{12}/_{4}$ 93. MALME 770.).

Herba perennis circiter 0,5 m. alta, radice incrassata, subcarnosa, floribus albis.

E. vernoniopsis Sch. Bip. — Baker, l. c. pag. 334.

Rio Grande do Sul: São Martinho pr. Santa Maria (In campo arenoso, aprico. 18 $^{25}/_{4}$ 93. Malme 802 B.), Cachoeira (18 $^{10}/_{5}$ 93. Malme 802 Bβ.).

Specimina nostra a forma typica nonnullis notis differt, ex. gr. foliis plerisque oppositis, quamobrem descriptio sequens detur:

Herba perennis, 40—50 cm. alta, simplex v. apice parce ramosa, erecta, radice crassa tortuosa. *Caulis* teres, parce tomentosus v. scabriusculus, usque ad inflorescentiam foliatus. *Folia* inferiora et sæpe media opposita, superiora alternantia, sat distantia (internodiis inferioribus 1—2 cm., superioribus usque ad 3 cm. et ultra longis), apicem caulis versus valde decrescentia (media majora usque ad 5 cm. longa, 3—3,5 cm. lata, superiora 2 cm. longa, 1 cm. lata), sessilia, patentia v. sæpe reflexa, ovata v. late elliptica, apice acuta, basi late cuneata integerrima, ceterum crenato-serrata, pilis supra parcis, subtus paullulo densioribus, mollibus vestita, margine scabrida, nervis secundariis utroque latere vulgo 2—3, arcuatis, angulo circiter 30° insidentibus; venis haud multum prominentibus. *Inflorescentia* terminalis, corymbosa, sat ampla, usque ad 10 cm. lata, pedicellis calathidiorum valde inæquilongis, vulgo circiter 5 mm. longis, dense pilosis. *Calathidia* 7—8 mm. longa, 8—10-flora; *involucri* campanulati *squamæ* circiter 12, roseo-violaceæ, valde inæquilongæ, inferiores sat anguste lanceolatæ, 2—3 mm. longæ, acutæ, superiores linearilingulatæ, obtusissimæ, usque ad 5 mm. longæ, usque ad 1,5 mm. latæ, dorso sat parce — sat dense pilosæ, apice densissime albido- v. roseolo-villosæ. *Corollæ* roseo-violaceæ, ex involucro longe exsertæ, circiter 5 mm. longæ, tubo sensim paullulum dilatato; lobis s. dentibus limbi late triangulatis, circiter 0,5 mm. longis latisque, acutis, erectis, dorso (extus) glandulis nonnullis ornatis. *Stamina* inclusa. *Rami styli* albi, longe exserti, filiformes v. nonnihil clavati. *Achenia* turbinata, circiter 2 mm. longa, persistenter pilosa, pappi albidi, circiter 4 mm. longi setis numerosis (circiter 40).

Nominandum var. **roseoviolaceum** Malme; forsan pro propria specie sit habendum.

E. multicrenulatum Sch. Bip. — Baker, l. c. pag. 335.

Rio Grande do Sul: inter Silveira Martins et Cruz Alta (In campo subhumido. 18 $^{24}/_{3}$ 93. Malme 724 C.), Rincão dos Valles pr. Cruz Alta (In campo subhumido, ad marginem silvæ. 18 $^{20}/_{4}$ 93. Malme 792 B.); **Paraguay**: Piruyú (In prato humido. 18 $^{4}/_{2}$ 94. Anisits 480.).

Frutex (v. suffrutex) 1—2 m. altus, parce ramosus, ramis erectis, floribus roseo-violaceis.

E. dentatum Gardn. — Baker, l. c. pag. 337.

Matto Grosso: Coxipó Mirim pr. Cuyabá (In campo aperto, arenoso-glareoso, graminoso. 18 $^{30}/_{6}$ 94. Malme 1756 B.).

Flores albi, fragantes.

In vicinitate oppidi Caldas mensibus Aug. et Sept. floret.

E. kleinioides H. B. K. — Baker, l. c. pag. 342.

Matto Grosso: Cuyabá (Loco aperto, glareoso-arenoso, sat sicco. 18 $^{2}/_{12}$ 93. Malme s. n.), ibidem (18 $^{30}/_{12}$ 93. Malme 1266 B.), ibidem (In »cerrado», imprimis locis subapertis, subhumidis, parce graminosis. 18 $^{20}/_{4}$ 94. Malme 1560.).

Vulgo herba annua; rarius »annua hiemans» v. subbiennis, qualia sunt specimina Dec. 1893 collecta, ceterum non differentia.

E. macrophyllum L. — Baker, l. c. pag. 345.

Matto Grosso: Santa Anna da Chapada (In silva minus densa. 18 $^{19}/_{2}$ 94. Malme 1408.); **Paraguay**: Paraguari (In silva declivium montis Cerro Negro, parcissime. 18 $^{7}/_{8}$ 93. Malme 872. — Eodem loco jam legit Balansa (N:o 923 *a*) 18 $^{21}/_{6}$ 74.).

E. grande Sch. Bip. ap. Baker. — Baker, l. c. pag. 347.

Rio Grande do Sul: Santo Angelo pr. Cachoeira (In campo humido, graminoso. 18 $^{10}/_{2}$ 93. Malme 568.).

Herba perennis usque ad 75 cm. alta, floribus roseis v. roseo-violaceis.

E. macrocephalum Less. — Baker, l. c. pag. 358.

Rio Grande do Sul: Santo Angelo pr. Cachoeira (In campo subhumido, alte graminoso. 18 $^{19}/_{1}$ 93. Malme 482.).

E. betonicæforme (DC.) Baker. — Baker, l. c. pag. 362.

Rio Grande do Sul: Santo Angelo pr. Cachoeira (In campo; loco terra fere denudata, aqua pluviali aliquantulum stagnante. 18 $^{10}/_{2}$ 93. Malme 572 C.).

E. Candolleanum Hook. & Arn. — Baker, l. c. pag. 363.

Rio Grande do Sul: Santo Angelo pr. Cachoeira (In campo; loco terra fere nuda, aqua pluviali aliquantulum stagnante. 18 $^{11}/_{2}$ 93. Malme 572.), Cachoeira (Ejusmodi loco. 18 $^{20}/_{2}$ 93. Malme 616 B. — 18 $^{11}/_{5}$ 93. Malme 616 B*. Omnino defloratum.).

Copiosa fit innovatio per ramos e gemmis radicibus v. basi caulis affixis evolutos.

E. hecatanthum (DC.) Baker. — Baker, l. c. pag. 365.

Rio Grande do Sul: Silveira Martins pr. Santa Maria (Loco aperto, terra ± denudata, aqua pluviali aliquantulum stagnante. 18 $^{2}/_{3}$ 93. Malme 670.); **Paraguay**: Caballero (18 $^{14}/_{1}$ 94. Anisits 354.).

Huc pertinet Balansa 799 *a* (Paraguari, »Forêts du Cerro San Tomas». 18 $^{24}/_{4}$ 76).

Kanimia Gardn.

K. palustris Gardn. — Baker, l. c. pag. 370.

Matto Grosso: Coxipó Mirim pr. Cuyabá (Loco aperto, arenoso, subhumido, in consortio Cyperacearum etc. 18 $^{2}/_{4}$ 94. Malme 1510.).

Astereæ.

Grindelia Willd.

G. puberula Hook. & Arn. — Baker, Flor. brasiliensis, Fasc. LXXXVII, pag. 4.

Rio Grande do Sul: Porto Alegre (Loco arenoso, aprico, sicco. 18 $^{14}/_{10}$ 92. Malme 176.).

Suffrutex 0,35—0,5 m. altus. Florum odor *Calendulæ officinalis*.

Planta a nobis reportata foliis angustioribus (maximis usque ad 5,5 cm. longis, 1 cm. latis), dense glandulosis a Sellowianis differt. Dicatur f. *angustifolia* Malme.

Inulopsis O. Hoffm.

I. scaposa (DC.) O. Hoffm. — O. Hoffmann in Engler und Prantl, Die natürl. Pflanzenfam. IV Teil, 5. Abteil. pag. 149. — Baker, l. c. pag. 6 (*Leucopsis scaposa* (DC.) Baker).

Minas Geraes: São João del Rey (In campo aprico, arenoso, lapilloso, paullo ante flammis vexato. 18 $^{31}/_{8}$ 92. Malme 16.).

Ligulæ albæ (haud luteæ, ut sæpe indicatur).

Noticastrum DC.

N. eriophorum Remy. — Baker, l. c. pag. 7 (*Leucopsis sericea* Less. var. *eriophora* (Remy) Baker).

Rio Grande do Sul: Ilha dos Marinheiros pr. oppidum Rio Grande (In arena mobili; loco ventoso, sat sicco. 18 $^{24}/_{11}$ 92. Malme 362.).

Ligulæ albidæ v. violaceo-purpurascentes (haud luteæ).

N. calendulaceum (Griseb.) Malme. — Baker, l. c. pag. 9 (*Leucopsis calendulacea* (Griseb.) Baker).

Rio Grande do Sul: oppidum Rio Grande (Loco arenoso, aprico, secundum viam ferream. 18 $^{19}/_{11}$ 92. Malme 394.).

Ligulæ albæ v. violaceo-purpurascentes.

Ad *N. sericeum* (Less.) arcte accedunt specimina nostra.

Forsan cum *Asteris* genere sint conjungendæ hæ species.

Leucopsis Baker (ex p.).

L. Tweediei (Hook. & Arn.) Baker. — Baker, l. c. pag. 9.

Rio Grande do Sul: Cruz Alta (In palude graminosa, aperta. 18 $^{13}/_{4}$ 93. Malme 778.).

Ligulæ (ut discus) luteæ.

In vicinitate oppidi Caldas (Minas Geraes) mensibus Jan.—Maj. floret.

A ceteris speciebus a celeberr. Baker ad hoc genus ductis valde recedit; forsan cum *Haplopappo* Cass. jungenda sit ideoque genus *Leucopsis* Baker omnino delendum.

Solidago L.

S. microglossa DC. (emend.) — Baker, l. c. pag. 10.

Rio Grande do Sul: pluribi; specimina reportavimus e Cachoeira (In campo aprico, inter myrtaceas fruticosas et Vernonias. 18 $^{20}/_{2}$ 93. Malme 610.), Silveira Martins pr. Santa Maria (Ruderalis et in »roças» vetustis. 18 $^{22}/_{3}$ 93. Malme 722.); **Paraguay**: Asuncion (18 $^{28}/_{11}$ 93. Anisits 143. Flores nondum bene evoluti.).

Inter vulgatissimas Compositas civit. Rio Grande do Sul censenda, præsertim in cultis, rarius in campis occurrens.

Hibernat stolonibus horizontalibus, hypogæis, subaphyllis.

Hysterionica Willd.

H. pinifolia (Poir.) Baker. — Baker, l. c. pag. 12.

Rio Grande do Sul: Porto Alegre (In declivibus collium; locis arenosis, apricis. 18 $^{15}/_{10}$ 92. Malme 180. — 18 $^{31}/_{5}$ 93. Malme 820.), Senandes pr. oppid. Rio Grande (In campo; loco aprico, arenoso, subnudo. 18 $^{25}/_{11}$ 92. Malme 370.).

Suffrutex 1—1,$_5$ dm. altus. Ligulæ luteæ, dein, tempore postflorationis, purpurascentes.

H. montevidensis (Spreng.) Baker. — Baker, l. c. pag. 13.

Rio Grande do Sul: Rincão dos Valles pr. Cruz Alta (In campo, secundum viam; loco sicco, terra ± denudata. 18 $^{20}/_{4}$ 93. Malme 792.).

Herba annua, ligulis albis v. leviter purpurascentibus.

Podocoma Cass.

P. hieraciifolia (Poir.) Cass. — Baker, l. c. pag. 15.

Rio Grande do Sul: Cachoeira (In campo aprico, sat graminoso. 18 $^{11}/_{5}$ 93. Malme 814 B.).

Specimina reportata minus bona, haud certe determinanda.

P. hirsuta Baker. — Baker, l. c. pag. 15.

Rio Grande do Sul: Silveira Martins pr. Santa Maria (In pascuo subumbroso. 18 $^{28}/_{2}$ 93. Malme 674.).

Asteropsis Less.

A. macrocephala Less. — Baker, l. c. pag. 17.

Rio Grande do Sul: Campos da Cima da Serra, pluribi in campis arenosis, apricis, siccis; specimina reportavimus e Cruz Alta (18 $^{12}/_{4}$ 93. Malme 728 *β*.), inter Silveira Martins et Cruz Alta (18 $^{25}/_{3}$ 93. Malme 728.).

Ligulæ albæ v. leviter roseo-violascentes.

Heterothalamus Less.

H. psiadioides Less. — Baker, l. c. pag. 19.

Rio Grande do Sul: Porto Alegre (In collibus arenoso-glareosis, apricis. 18 $^{1}/_{11}$ 92. Malme 244 B. — 18 $^{2}/_{6}$ 93. Malme 826 B.).

Frutex valde ramosus, usque ad 1 m. altus, foliis glutinosis, ligulis flavis nitentibusque. Mensibus Jun.—Octobr.(—Novembr.) floret.

Aster L.

A. calocephalus Malme n. sp.

Ic.: tab. nostr. IV fig. 13.

Herba perennis, circiter 0,5 m. alta. *Caulis* simplex, erectus v. basi nonnumquam (forsan haud normaliter) decumbens, pro rata gracilis, teres, striatus, glaberrimus, sæpe purpurascens, usque ad apicem foliatus. *Folia* numerosissima, sat densa v. haud multum distantia (internodiis 0,5—2 (raro —3) cm. longis), apicem caulis versus decrescentia, amplexicaulia, erecta v. erecto-patentia, sæpe curvata, integerrima, acutissima, 1—3-nervia, supra et subtus glaberrima, margine pilis brevibus, adpressis, rigidis, parcis scabriuscula; inferiora sæpe anguste oblanceolata, 5—6 cm. longa, circiter 4 mm. lata; cetera e basi lata linearia v. sensim angustata et fere subulata, sæpe ± canaliculata; majora (media) usque ad 8—9 cm. longa, (explanata) 2—2,5(—3) mm. lata, superiora sæpe vix 4 cm. longa. *Inflorescentia* sat oligocephala (calathidiis 4—10), laxa, pedicellis calathidiorum glabris, sat erectis, vulgo circiter 3 cm. longis, squamis vulgo 7, 3—4 mm. longis, amplexicaulibus, acutis, margine leviter ciliatis, sæpe atropurpureis instructis. *Calathidia* (cum ligulis) 13—15 mm. longa, heterogama. *Involucri* campanulati, 7—8 mm. longi *squamæ* 30—40, valde inæquilongæ, multiseriatæ, dorso glabræ, margine vulgo parce breviterque ciliatæ, præsertim apicem versus ± atropurpureæ, late albohyalino-marginatæ, inferiores (2—)3—4 mm. longæ, lanceolatæ v. lineari-lanceolatæ, acutæ, superiores oblanceolatæ v. anguste lingulato-oblanceolatæ, acutæ v. brevissime acuminatæ, apice deltoideæ, usque ad 7—7,5 mm. longæ, circiter 1,5 (rarius usque ad 2) mm. latæ. *Ligulæ* 30—40 (cum ovario) circiter 13 mm. longæ, tubo gracili, circiter 3 mm. longo, superne pilis gracilibus parce ornato; limbo coeruleo, circiter 9 mm. longo, 1,5 mm. lato, sublineari v. anguste lingulato, apice sat indistincte tridentato; rami

styli vix 1 mm. longi, circiter 0,15 mm. lati, lineari-oblongi, obtusi (v. rarius subacuti et tum apice ± barbati). *Flores disci* numerosi, 8—9 mm. longi, tubi parte dimidia inferiore gracili cylindracea, extus glabra, superiore sensim manifeste dilatata, extus inferne pilis gracilibus, filiformibus ornata; dentibus s. lobis limbi erectis v. conniventibus, ovato-triangularibus, 0,75—1 mm. longis, circiter 0,5 mm. latis acutiusculis, dorso (extus) pilis minutis, clavatis v. subfiliformibus parce ornatis; stamina inclusa v. nonnihil exserta; stylus (in floribus plurimis examinatus) inclusus v. subinclusus (an semper persistenterque?), ramis circiter 0,75 mm. longis, appendicibus breviter barbatis, semiconicis v. anguste triangularibus, acutis, circiter 0,6 mm. longis auctis. *Achenia* (immatura) circiter 3 mm. longa, glaberrima, pappi albidi v. rufescentis, 6—7 mm. longi setis circiter 40, manifeste ciliatis.

Rio Grande do Sul: prope São Martinho (pr. Santa Maria) (In campo; loco uliginoso graminoso. 18 $^{25}/_{4}$ 93. MALME 800.).

Aster caricifolius H. B. K. (Nov. gen. et spec. plant. Tom. IV, pag. 92 et tab. 333), haud dissimilis, differt foliis semiamplexicaulibus, acutiusculis v. subobtusis, pedicellis calathidiorum superne viscoso-hirtellis, squamis involucri angustioribus, viscosis, ligulis albis etc.

Ab *A. Regnellii* (SCH. BIP.) BAKER recedit nostra species foliis multo numerosioribus, angustioribus rigidisque, calathidiis paucioribus majoribusque, squamis involucri coloratis etc.

Formæ saltem valde similes ex America australi reportatæ in herbb. *A. caricifolius* nuncupatæ sunt.

A. Regnellii (SCH. BIP.) BAKER. — BAKER, l. c. pag. 21.

* **mattogrossensis** MALME n. subsp.

Herba perennis, circiter 1 m. alta. *Caulis* simplex, erectus, teres, striatus v. leviter costatus, glaberrimus, usque ad inflorescentiam foliatus. *Folia* numerosa, sat distantia (internodiis vulgo 3—4 cm. longis), apicem caulis versus valde descrescentia, semiamplexicaulia, ± erecta, integerrima, acuta, majora 3-nervia, venis sat conspicuis, supra et subtus glabra, margine haud ciliata scabridave, anguste oblanceolato-linearia v. linearia v. (superiora) fere subulata; inferiora majora usque ad 10—12 cm. longa, 5 mm. lata; superiora (sensim in bracteas inflorescentiæ transeuntia) 2—5 cm. longa, 1—2 mm. lata. *Inflorescentia* corymbosa, sat oligocephala (calathidiis 5—12), ampla, usque ad 20 cm. lata, laxissima, pedicellis calathidiorum 5—7 cm. longis, glabris, erecto-patentibus, bracteis triangulari-subulatis, adpressis, circiter 3 mm. longis ornatis. *Calathidia* (cum ligulis) circiter 15 mm. longa, heterogama. *Involucri* campanulati, usque ad 9—10 mm. longi *squamæ* 30—40, valde inæquilongæ, multiseriatæ, dorso glabræ, margine præsertim apicem versus ciliatæ, virides v. stramineo-virides, sæpe anguste subhyalino-marginatæ, inferiores 3—5 mm. longæ, vix 1 mm. latæ, anguste lanceolato-triangulares, superiores lineares, 7—9 mm. longæ, 1—1,25 mm. latæ, acutæ v. breviter acuminatæ, apice deltoideo extus intusque levissime pubescente. *Ligulæ* 15—20, albæ v. dilute roseo-lilacinæ, ovario excepto usque ad 12 mm. longæ, tubo gracili, cylindraceo, parte dimidia superiore pilis gracilibus, filiformibus parce ornato; limbo usque ad 2 mm. lato, lingulato, apice sat indistincte tridentato, glabro; rami styli circiter 1 mm. longi,

lineares, obtusi. *Flores disci* numerosi; corolla 6—7 mm. longa, tubi parte dimidia inferiore gracili, cylindracea, glabra, superiore sensim manifeste dilatata, præsertim inferne, pilis gracilibus, filiformibus sat parce ornata; lobis s. dentibus limbi ovato-triangularibus, erectis v. paullulum conniventibus, acutiusculis, circiter 0,75 mm. longis, circiter 0,5 mm. latis, dorso pilis ± clavatis parce ornatis; stylus ut in specie præcedente, appendicibus paullulum exsertis. *Achenia* 3—4,5 mm. longa, glabra, pappi rubelli v. fulvescentis, 6—7 mm. longi setis 30—40, manifeste ciliatis.

Matto Grosso: Guia pr. Cuyabá (In ripa rivuli aperta, humida, graminosa. 18 $^{13}/_{5}$ 94. MALME 1620.).

Compluribus notis, ex. gr. foliis numerosioribus angustioribusque, inflorescentia laxiore, involucri longioris squamis pro rata angustioribus, semper acutis (v. acuminatis) ab *A. Regnellii* (SCH. BIP.) BAKER differt nostra planta; forsan pro propria specie sit habenda.

A. exilis ELL. — ASA GRAY, Synoptical Flora of North America (1886) pag. 203. — BAKER, l. c. pag. 21 (*Aster divaricatus* TORR. & GRAY).

Rio Grande do Sul: Cachoeira (In campo, locis terra ± nuda, aqua pluviali aliquantulum stagnante 18 $^{22}/_{2}$ 93. MALME 628.).

A. exilis ELL. var. **graminifolius** (SPRENG.). — BAKER, l. c. pag. 22 (sub *A. divaricato*).

Rio Grande do Sul: Cachoeira (18 $^{11}/_{5}$ 93. MALME 628 *γ*.).

A. setosus BAKER. — BAKER, l. c. pag. 22.

Rio Grande do Sul: prope vicum São Martinho pr. Santa Maria (Loco aperto, arenoso, sicco, terra denudata. 18 $^{26}/_{4}$ 93. MALME 802 C.).

Planta a nobis reportata cum specimine archetypico omnino congruit; species ab *A. tuberoso* LESS. vix diversa.

Sommerfeltia LESS.

S. spinulosa (SPRENG.) LESS. — BAKER, l. c. pag. 27.

Rio Grande do Sul: Porto Alegre (In campo arenoso, aprico. 18 $^{25}/_{5}$ 93. MALME 816 B. Fere omnino deflorata.).

Erigeron L.

E. bonariensis L. — BAKER, l. c. pag. 30.

Rio Grande do Sul: Cachoeira (In campo aprico, inter Myrtaceas et Vernonias. 18 $^{20}/_{2}$ 93. MALME 608.).

In civit. Rio Grande do Sul pluribi observavimus, ex. gr. in campis inter Silveira Martins et Cruz Alta.

Conyza L.

C. triplinervia Less. — Baker, l. c. pag. 33.

Rio Grande do Sul: pluribi; specimina reportavimus e Cachoeira (In campo; loco subhumido, terra fere nuda. 18 $^{24}/_{2}$ 93. Malme 660 C.), Silveira Martins pr. Santa Maria (In pascuis subhumidis nec non in »capoeiras» novis. 18 $^{13}/_{3}$ 93. Malme 706.).

Herba perennis usque ad 1 m. alta, foliis novellis glutinosis.

C. arguta Less. — Baker, l. c. pag. 33.

Rio Grande do Sul: Santo Angelo pr, Cachoeira (Loco subhumido, sat aperto, terra fere nuda. 18 $^{10}/_{2}$ 93. Malme 556.).

C. notobellidiastrum Griseb. — Baker, l. c. pag. 34.

Rio Grande do Sul: colonia Ijuhy (In silva primæva, juxta viam. 18 $^{5}/_{4}$ 93. Malme 756 B.), Santa Maria (In »capão»; loco sat umbroso. 18 $^{7}/_{5}$ 93. Malme 756 B β.)

In vicinitate oppidi Caldas mense Octobr. florentem collegerunt Lindberg, Regnell, Mosén.

C. chilensis Spreng. — Baker, l. c. pag. 35.

Rio Grande do Sul: pluribi; specimina reportavimus e Canôas pr. Porto Alegre (In campo subhumido, graminoso, secundum viam ferream. 18 $^{10}/_{11}$ 92. Malme 292.), Cachoeira (In campo arenoso, graminoso, sat sicco. 18 $^{22}/_{2}$ 93. Malme 640. — 18 $^{10}/_{5}$ 93. Malme 640*. Pro parte maxima deflorata.). **Paraguay**: Colonia Risso pr. Rio Apa (In campo argillaceo-arenoso, graminoso, sat sicco. 18 $^{20}/_{10}$ 93. Malme 1090 D.).

Baccharis L.

B. articulata (Lam.) Pers. — Baker, l. c. pag. 38.

Rio Grande do Sul: pluribi in campis, imprimis subhumidis humidisve, copiosissima; specimina solummodo sterilia reportavimus e Santa Maria (18 $^{30}/_{4}$ 93. Malme 826 D.).

Frutex usque ad 1 m. altus, colore glauco a ceteris hujus generis speciebus alatis jam e longinquo dignotus.

B. genistelloides (Lam.) Pers. *trimera (Less.) DC. — Baker, l. c. pag. 41 (pro var.)

Rio Grande do Sul: pluribi in campis sat siccis siccisve copiosissima; specimina reportavimus e Santo Angelo pr. Cachoeira (18 $^{21}/_{1}$ 93. Malme 536.), Cachoeira (18 $^{11}/_{5}$ 93. Malme s. n. Pro parte maxima deflorata.).

Suffrutex circiter 0,5 m. altus.

B. Glaziovii Baker. — Baker, l. c. pag. 44.

Rio Grande do Sul: Hamburgerberg (In pascuo subhumido. 18 $^{20}/_{10}$ 92. Malme 198.).
Frutex usqne ad 1,5 m. altus.
In vicinitate oppidi Caldas (civit. Minas Geraes) eandem speciem jam anno 1867 legit Regnell (III: 1592).

B. artemisioides Hook. & Arn. — Baker, l. c. pag. 47.

Rio Grande do Sul: Porto Alegre (Gregatim in campo arenoso, aprico. 18 $^{29}/_{5}$ 93. Malme 820 B. Fere omnino deflorata.).

B. leucopappa DC. — Baker, l. c. pag. 51 (pro var. *B. helichrysoidis* DC.).

Rio Grande do Sul: Hamburgerberg (Loco uliginoso, sat alte graminoso. 18 $^{21}/_{10}$ 92. Malme 224.).
Frutex usque ad 0,75 m. altus.

B. coridifolia DC. — Baker, l. c. pag. 57.

Rio Grande do Sul: Cachoeira (In campo sicco, aprico. 18 $^{11}/_{5}$ 93. Malme 808.).

B. tenuifolia DC. — Baker, l. c. pag. 63 [*B. rufescens* var. *tenuifolia* (DC.)].

Rio Grande do Sul: Cachoeira (In campo sicco, aprico. 18 $^{24}/_{2}$ 93. Malme 656.).
Frutex usque ad 0,5 m. altus.
Specimina a nobis reportata forsan ad var. sequentem sint referenda.

B. tenuifolia DC. var. **leptophylla** (DC.) — Baker, l. c. pag. 63 [*B. rufescens* var. *leptophylla* (DC.)].

Rio Grande do Sul: inter col. Ijuhy et Cruz Alta (In campo arenoso, aprico, sicco. 18 $^{11}/_{4}$ 93. Malme 762.), Cruz Alta (18 $^{13}/_{4}$ 93. Malme 762 *β*.).
Suffrutex campestris circiter 0,25 m. altus, sæpe ramosissimus.

B. varians Gardn. — Baker, l. c. pag. 63 [*B. rufescens* var. *varians* (Gardn.)].

Paraguay: Areguá pr. Asuncion (In fruticeto, »capoeira». 18 $^{22}/_{7}$ 93. Malme 852.).
Frutex ramosissimus circiter 3 m. altus.

B. platensis Spreng. — Baker, l. c. pag. 67.

Rio Grande do Sul: Silveira Martins pr. Santa Maria (In »capoeira». 18 $^{18}/_{3}$ 93. Malme 718.).
Frutex usque ad 2 m. altus, parce ramosus, ramis erectis v. erecto-patentibus.

B. megapotamica Spreng. — Baker, l. c. pag. 68.

Rio Grande do Sul: in vicinitate vici São Martinho pr. Santa Maria (In campo; in palude graminosa. 18 $^{25}/_{4}$ 93. Malme 802.).

Etiam pluribi in humidis paludibusque inter Santa Maria et Cachoeira est observata.

In vicinitate oppidi Caldas mense Octobr. florentem legerunt REGNELL, MOSÉN.

B. dracunculifolia DC. — BAKER, l. c. pag. 71.

Rio Grande do Sul: copiosissima in »capoeiras» aliisque fruticetis; specimina reportavimus e Silveira Martins pr. Santa Maria (18 $^{28}/_{3}$ 93. MALME 666.), Santa Maria da Bocca do Monte (18 $^{3}/_{5}$ 93. MALME 806 C.); **Paraguay**: Colima del Cerro Pindo, ad viam inter Pirayú et Peribebuy. (18 $^{4}/_{2}$ 94. ANISITS 500.).

B. trinervis (LAM.) PERS. — BAKER, l. c. pag. 73.

Matto Grosso: Buriti par. Santa Anna da Chapada (In »capoeira». 18 $^{27}/_{6}$ 94. MALME 1750.).

B. punctulata DC. — BAKER, l. c. pag. 77 [*B. oxyodonta* var. *punctulata* (DC.)].

Rio Grande do Sul: pluribi in »capoeiras»; specimina reportavimus ex Hamburgerberg (18 $^{25}/_{10}$ 92. MALME 230 A. Sterilis.), Silveira Martins pr. Santa Maria (18 $^{18}/_{3}$ 93. MALME 712.).

Foliorum basis lamina revoluta domicilium arachnidis seu *domatium* præbet, ut sæpe in arboribus fruticibusque margines silvularum silvulasque minus densas hujus regionis inhabitantibus fit.

B. anomala DC. — BAKER, l. c. pag. 77.

Rio Grande do Sul: pluribi in sæpibus marginibusque silvarum; specimina reportavimus e Santo Angelo pr. Cachoeira (18 $^{2}/_{2}$ 93. MALME 532.).

B. pentodonta MALME n. sp.

Ic.: tab. nostr. IV fig. 12.

»Radix multiceps» brevis, incrassata, lignosa, *caules* plures emittens circiter 0,35 m. altos, erectos, ramosissimos, ramis erecto-patentibus, basin versus 2—3 mm. crassos, glabros, juniores costatos glutinososque. *Folia* alternantia, haud multum distantia (internodiis caulis vulgo 0,5—1 cm., ramorum 0,25—0,5 cm. longis), uninervia, sessilia, oblanceolato- v. obovato-cuneata, profunde quinque-(rarius tri- v. septem-)dentata, dentibus patentissimis, obtusis, et supra et subtus glabra, saltem juniora glutinosa, caulina majora, usque ad 15 mm. longa, 7 mm. lata, ramorum sæpissime minora, circiter 10 mm. longa, vix 5 mm. lata. *Calathidia* in apicibus ramulorum brevissimorum, secundum ramos dispositorum v. in apice ramorum dense capitato-conglomerata, foliis brevibus s. bracteis suffulta, sessilia, 5—7(—8)-flora, feminea 6—7 mm., mascula 4—5 mm, longa. *Involucri* subcylindraceæ *squamæ* 15—20, valde inæquilongæ, albido-stramineæ, obtusiusculæ, anguste subhyalino-marginatæ, dorso glabræ, margine apicem versus tenuissime ciliatæ, infimæ brevissimæ,

vix 1 mm. longæ, ovatæ, mediæ ovato-lanceolatæ v. lanceolatæ, superiores lineari-lanceolatæ v. in calathidiis femineis lineares, vix 1 mm. latæ, in calathidiis masculis usque ad 4 mm., in calathidiis femineis usque ad 6 mm. longæ. *Flores* non v. paullulum ex involucro exserti; *masculi* tubo circiter 3 mm. longo, cylindraceo, extus superne pilis (s. glandulis) brevibus, clavatis, sat raris ornato, limbi quinquepartiti lobis 1,5—1,75 mm. longis, circiter 0,33 mm. latis, lineari-lanceolatis, acutiusculis, mox revolutis, apicem versus extus pilis (s. glandulis) nonnullis brevissimis ornatis, ceterum glabris; stamina longe exserta; stylus demum e tubo stamineo sat longe exsertus, apice anguste conoideo, barbato; achenii rudimentarii pappus floribus æquilongus v. longior, setis apice incrassatis et distinctius ciliatis; *feminei* limbo deficiente, tubo filiformi, e basi pro rata sat crassa sensim angustato, tenuissimo, vix 4 mm. longo, apicem versus pilis brevibus, clavatis, ± adpressis ornato; stylus longe exsertus, usque ad 6 mm. longus, ramis circiter 1 mm. longis, sublinearibus, gracilibus, acutis (apice haud barbatis). *Achenia* (immatura) glabra, pappi 6—7 mm. longi, albidi setis numerosis, apice haud incrassatis, indistincte ciliatis.

Rio Grande do Sul: Cruz Alta (In campo aprico, arenoso. 18 $^{12}/_{4}$ 93. MALME 772.).

*B. paucifloscul*osæ DC. affinis; differt foliis multo minoribus, uninervibus, profundius dentatis, dentibus patentissimis, involucris minoribus , squamis obtusiusculis etc.

A *B. incisa* HOOK. & ARN. differt inflorescentia capitato-conglomerata, foliorum dentibus obtusis, involucri squamis multo numerosioribus, pro rata latioribus etc.

B. subopposita DC. var. **affinis** (DC.) BAKER. — BAKER, l. c. pag. 91.

Rio Grande do Sul: Cachoeira (Ad ripam rivuli; loco arenoso-glareoso, aprico. 18 $^{22}/_{2}$ 93. MALME 638.).

Frutex usque ad 1 m. altus.

B. humilis SCH. BIP. — BAKER, l. c. pag. 92.

Minas Geraes: São João del Rey (In campis apricis, arenosis, lapillosis, paullo ante flammis vexatis. 18 $^{51}/_{8}$ 92. MALME 20.).

B. rotundifolia SPRENG. — BAKER, l. c. pag. 98.

Rio Grande do Sul: Porto Alegre (In declivibus collium campi; locis arenosis, apricis. 18 $^{29}/_{5}$ 93. MALME 824.).

Specimina a nobis reportata sistunt variationem verisimiliter e loco natali (campo quotannis a flammis vexato) ortam: Caules numerosi e »radice multicipite» crassa emissi, erecti, simplices v. parce ramosi, 25—30 cm. alti; folia eadem forma ac in speciminibus Sellowianis (aliisque in herb. Musei bot. Berolin. asservatis) at sæpe majora, maxima usque ad 3 cm. longa, 2,25 cm. lata; involucra calathidiorum femineorum usque ad 13 mm. longa.

B. subcapitata GARDN. — BAKER, l. c. pag. 98.

Matto Grosso: Cuyabá (In campo; loco aperto, glareoso, sicco, parce graminoso. 18 $^{30}/_{12}$ 93. MALME 1286 B.).

Specimina nostra cum Riedelianis — *B. polylepis* SCH. BIP. in sched. — plane congruunt.

Inuleæ.

Stenachenium BENTH.

St. megapotamicum (SPRENG.) BAKER. — BAKER, Flor. brasiliensis, Fasc. LXXXVII, pag. 105.

Rio Grande do Sul: Santo Angelo pr. Cachoeira (In cultis nec non in »capoeira» nova. 18 $^{11}/_{2}$ 93. MALME 570 C.), Silveira Martins pr. Santa Maria (Ruderalis nec non in »capoeiras» novis, copiose. 18 $^{1}/_{3}$—$^{18}/_{3}$ 93. MALME 672 B.).

In civitat. Rio Grande do Sul pluribi, præsertim in cultis, rarius in campis subhumidis.

Herba saltem sæpe annua, foetida.

St. campestre BAKER. — BAKER, l. c. pag. 105.

Rio Grande do Sul: pluribi in campis siccis, arenosis; specimina reportavimus e Porto Alegre (18 $^{1}/_{11}$ 92. MALME 238.) et e Cachoeira (18 $^{10}/_{5}$ 93, omnino deflorata).

Herba perennis; hibernat stolonibus hypogæis subaphyllis, apice erecto rosula foliorum munitis.

Pluchea CASS.

P. quitoc DC. — BAKER, l. c. pag. 106. — *Pl. suaveolens* (VELL.) OK.

Rio Grande do Sul: Santo Angelo pr. Cachoeira (Loco aperto, subhumido, terra fere nuda. 18 $^{10}/_{2}$ 93. MALME 570 B.), Silveira Martins pr. Santa Maria (In pascuis, locis aqua pluviali aliquantulum stagnante. 18 $^{28}/_{2}$ 93. MALME 672.), Cachoeira (18 $^{11}/_{5}$ 93. MALME 672*, omnino deflorata.).

Tessaria R. & P.

T. integrifolia R. & P. — BAKER, l. c. pag. 108.

Paraguay: Gran Chaco (Copiosa in ripa fluminis Pilcomayo. 18 $^{4}/_{9}$ 93. MALME 909, omnino deflorata.).

Arbor sat parva, habitu fere *Populi pyramidalis*, ramis erectis, cortice tenui, lævigato.

Plane congruit cum planta a BALANSA collecta (N:o 863), quæ floribus hermaphroditicis in calathidiis singulis gaudet neque ullo pacto ad *T. absinthioidem* (HOOK. & ARN.) est referenda.

Pterocaulon Ell.[1]

Pt. angustifolium DC. — DC. Prodr. V, pag. 454.

Rio Grande do Sul: Santo Angelo pr. Cachoeira (In campo aprico, sicco, parce graminoso. 18 $^{11}/_{2}$ 93. Malme 570.), Cachoeira (18 $^{20}/_{2}$ 93. Malme 604.).

Pt. purpurascens Malme mscr.

Paraguay: Colonia Risso pr. Rio Apa (In campo hinc inde Coperniciis obsito, paullo ante flammis vexato. 18 $^{30}/_{9}$ 93. Malme 1014.), Guarda Francia pr. Rio Apa (In ripa fluminis Paraguay, loco aperto, arenoso, parce graminoso. 18 $^{17}/_{10}$ 93. Malme 1014*.).

Ad hanc speciem pertinet Balansa N:o 838 (»Plaine d'Areguá, dans les argiles imperméables. 10 Janvier 1875».).

Pt. Bakeri Malme n. nom.

Syn. *Vernonia pterocaulon* Baker, in Journ. Bot. XVI (1878), pag. 77; minime *Pterocaulon interruptum* DC., ut suspicatus est cl. O. Hoffmann.

Rio Grande do Sul: Cruz Alta (In campo aprico; in consortio aliorum *Pterocaulorum*, *Achyroclines* etc. 18 $^{13}/_{4}$ 93. Malme 826 Cβ.), Porto Alegre (In campo aprico, paullo ante flammis vexato. 18 $^{31}/_{5}$ 93. Malme 826 C.).

Pt. subvirgatum Malme mscr.

Paraguay: Colonia Risso pr. Rio Apa (In campo hinc inde Coperniciis obsito; in consortio *Pt. purpurascentis*. 18 $^{30}/_{9}$ 93. Malme 1014 B. Specimina fere deflorata.).

Ad eandem speciem pertinet Balansa N:o 836 (»Cerro Peron près de Paraguari, dans les lieux herbeux». 18 $^{19}/_{2}$ 75.).

Pt Lorentzii Malme mscr.

Rio Grande do Sul; Cachoeira (In campo aprico, arenoso, parce graminoso. 18 $^{16}/_{2}$ 93. Malme 578.).

Pt. interruptum DC. — DC. Prodr. V, pag. 454.

Rio Grande do Sul: Colonia Ijuhy (In »roças» vetustis, secundum vias in silva etc. 18 $^{30}/_{3}$ 93. Malme 740.). E diario nostro etiam in campis occurrit, ex. gr. inter Cruz Alta et Santa Maria.

Aeque ac *Pt. angustifolium*, *Pt. Lorentzii* et *Pt. alopecuroideum* f. pluribi in civit. Rio Grande do Sul observatum est.

E diario nostro pluribi in paludosis humidisque camporum inter Cruz Alta et Santa Maria occurit *Pt. polystachyum* DC., at specimina non reportavimus.

[1] Genus *Pterocaulon* Ell. mox seorsim tractabimus, quamobrem species novas hic non describimus.

Lucilia Cass.

L. acutifolia (Poir.) Cass. — Baker, l. c. pag. 112.

Rio Grande do Sul: Cachoeira (In campo aprico, arenoso, breviter graminoso. 18 $^{16}/_{2}$—$^{29}/_{2}$ 93. Malme 586.).

L. nitens Less.— Baker, l. c. pag. 113.

Rio Grande do Sul: Cachoeira (In campo aprico, sat graminoso. 18 $^{11}/_{5}$ 93. Malme 812 C.).

Hibernat stolonibus hypogæis, subhorizontalibus, subaphyllis.

Achyrocline DC.

A. satureoides (Lam.) DC. (emend.). — Baker, l. c. pag. 115.

Var. 1: foliis anguste oblanceolatis, circiter 5 cm. longis, 0,5 cm. latis, supra sat dense, subtus densius tomentosis, trinervibus, involucri squamis flavidis.

Rio Grande do Sul: Cachoeira (In campo aprico, arenoso. 18 $^{20}/_{2}$ 93. Malme 606.), colonia Ijuhy (18 $^{30}/_{3}$ 93. Malme 740 B. — Forma loco minus sicco crescens, foliis ab omni parte majoribus, usque ad 8 cm. longis, 0,75 cm. latis, minus dense tomentosis.).

Ad primariam *A. satureoidem* sensu Bakeri pertinet.

Var. 2: foliis oblanceolatis, 5—6 cm. longis, circiter 1,5 cm. latis, supra parce—parcissime, subtus sat dense tomentosis, involucri squamis stramineis v. fulvescenti-albicantibus.

Matto Grosso: Buriti par. Santa Anna da Chapada (In »cerrado» minus denso; loco arenoso, sicco. 18 $^{16}/_{6}$ 94. Malme 1682 C.).

Cum nulla varietatum a celeberr. Baker receptarum tute conjungenda.

Var. 3: foliis anguste lanceolatis, 2,5—3(—3,5) cm. longis, 0,3—0,5 cm. latis, supra sat dense, subtus densissime tomentosis, involucri squamis stramineis v. subsulphureis.

Rio Grande do Sul: Cruz Alta (In campo arenoso, aprico sicco. 18 $^{13}/_{4}$ 93. Malme 768.).

Ad var. *albicantem* (Griseb.) Baker proxime accedit.

Var. 1 et 3 inter vulgatissimas Compositas campestres civit. Rio Grande do Sul censendæ.

A. alata (H. B. K.) DC. — Baker, l. c. pag. 117.

Rio Grande do Sul: Cachoeira (Locis uliginosis, graminosis, apertis. 18 $^{24}/_{2}$ 93. Malme 660.).

Facelis apiculata Cass. (Baker, l. c. pag. 118) e diario nostro pluribi in civit. Rio Grande do Sul, ex. gr. ad margines viarum inter Silveira Martins et Cruz Alta, occurrit, at specimina non reportavimus.

Chevreulia Cass.

Ch. acuminata Less. — Baker, l. c. pag. 119.

Minas Geraes: Sitio (In campo arenoso, graminoso. 18 $^{29}/_{8}$ 92. Lindman 73.).

Gnaphalium L.

Gn. cheiranthifolium Lam. — Baker, l. c. pag. 122.

Rio Grande do Sul: Quinta pr. oppidum Rio Grande (In campo aprico, arenoso. 18 $^{3}/_{12}$ 92. Malme 410.). Pluribi in campis inter Cruz Alta et Santa Maria observatum.

Gn. Gaudichaudianum DC. — Baker, l. c. pag. 123 [*Gn. cheiranthifolium* var. *Gaudichaudianum* (DC.)].

Rio Grande do Sul: Santo Angelo pr. Cachoeira (In campo subhumido, terra fere nuda. 18 $^{11}/_{2}$ 93. Malme 566.).

Gn. purpureum L. — Baker, l. c. pag. 124.

* **spicatum** Lam.

Rio Grande do Sul: Cruz Alta (In campo humido parcissime. 18 $^{13}/_{4}$ 93. Malme 826 F.).

In **Paraguay**: Colonia Risso pr. Rio Apa (Ruderale nec non in campo, solo ± denudato. 18 $^{30}/_{9}$ 93. Malme 1012.) aliam hujus speciei polymorphæ et collectivæ, ut dicunt, legimus formam plantæ boreali-americanæ, vero et genuino *Gnaphalio purpureo* L., simillimam, quam paucis verbis describamus: Herba saltem sæpissime annua v. annua hiemans, usque ad 30 cm. alta, caule simplice, rarissime superne ramoso, erecto, dense laxeque albido-tomentoso. Folia inferiora anguste spathulata, usque ad 3 cm. longa, 7 mm. lata, superiora oblanceolata, 2—3 cm. longa, 3—4 mm. lata, omnia obtusiuscula et brevissime mucronata, supra sat parce araneoso-tomentosa, subtus dense laxeque albo-tomentosa. Inflorescentia (basi interrupte) conglomerato-spicata. Involucri basi crebre araneoso-tomentosi squamæ acutæ v. nonnullæ obtusiusculæ, brunneolæ.

A *Gnaphalio* * *spicato* Lam. jam indumento laxo, a *Gn.* * *spathulato* Lam. caule simplici, foliis angustioribus, subtus dense albo-tomentosis etc. recedit.

Heliantheæ.

Riencourtia Cass.

R. oblongifolia Gardn. — Baker, Flor. brasiliensis, Fasc. XCIII, pag. 144.

Matto Grosso: Cuyabá (In »cerrado» minus denso, arenoso-glareoso. 18 $^{3-9}/_{1}$ 94. Malme 1304.).

R. tenuifolia GARDN. — BAKER, l. c. pag. 144.

Matto Grosso: Cuyabá (Pluribi in »campos» apricis, arenoso-glareosis, siccis, parce graminosis. MALME 1190 B. 18 $^{28}/_{11}$ 93, 18 $^{12}/_{12}$ 93, 18 $^{13}/_{1}$ 94.).

Specimina a GARDNER reportata descriptaque non vidimus. Nostra e descriptione nonnullis notis, ex. gr. foliis paullulo latioribus, trinervibus, vulgo planis, bracteis brevioribus, calathidia vulgo haud superantibus, recedunt; quamobrem hic describantur:

Var. **intermedia** MALME n. var.

Ic.: tab. nostr. IV fig. 14.

Herba perennis usque ad 0,5 m. alta, »radice multicipite» incrassata, lignosa. *Caules* erecti v. basi adscendentes, simplices v. raro parcissime ramosi, graciles, 1—1,5 mm. crassi, teretes, striati, pilis brevibus, rigidissimis, ± adpressis, basin caulis versus raris, apicem versus sat densis scabri, fere usque ad apicem foliati. *Folia* opposita, sat distantia (internodiis basin caulis versus vulgo 3—4 cm., apicem versus 5—7 cm. longis), rigida, ± erecta, sessilia v. brevissime petiolata, linearia v. anguste oblanceolato-linearia, media (majora) 4—5(—5,5) cm. longa, 2—3(—4) mm. lata, acuta, integerrima, et supra et subtus pilis brevibus ± adpressis scabra, plana v. margine paullulum revoluta, trinervia, nervis subtus exsculptis, venis paucis obliquis, subtus prominentibus conjunctis. *Calathidia* ad apicem caulis capitato-conglomerata, bracteis suffulta ovato-triangularibus, acutis, involucra haud superantibus, dorso pilis adpressis, densis scabris (raro lanceolatis, longioribus, glomerulos superantibus), 4—5 mm. longa, floribus femineis singulis, masculis s. hermaphroditicis septenis. *Involucri squamæ* 4, subæquales, ovales v. obovatæ, obtusæ v. paullulum emarginatæ, mucronatæ, basin versus albido-subhyalinæ, glabræ, ceterum obscure virides, pilisque brevibus, crassis vestitæ. *Flos femineus* (cum ovario) circiter 4 mm. longus, ovario obovato v. ovali, compresso, apice et marginibus pilis longis, multi-articulatis dense vestito; tubo corollæ circiter 2 mm. longo, gracili, filiformi, subcylindraceo v. superne paullulum dilatato, apice bidentato pilisque nonnullis longis ornato, ceterum glabro; styli e tubo demum exserti ramis circiter 1,5 mm. longis, subfiliformibus, obtusis. *Flores masculi* (s. hermaphroditici) in anthesi 4—5 mm. longi; limbi corollæ anguste campanulati, 2—2,5 mm. longi, quinquefidi lobis anguste triangularibus, vix 1 mm. longis, circiter 0,5 mm. latis, obtusis, erectis v. demum patentibus, intus (supra) papillis longis densisque ornatis, margine et extus (subtus) apicem versus pilis longis, uni—pauci-articulatis, scabridulis, sat crassis dense vestitis, ceterum glabris; tubo filiformi, cylindraceo, basi et apicem versus pilis raris, gracilibus, multiarticulatis ornato, ceterum glabro, post anthesin (limbo delapso) elongato, usque ad 4 mm. longo, persistente. *Stamina* demum e corolla exserta, filamentis vix 0,5 mm. longis, antheris 1—1,25 mm. longis, basi brevissime sagittatis, appendicibus apicalibus late ovato-triangularibus, obtusiusculis, circiter 0,2 mm. longis, usque ad 0,3 mm. latis, haud hyalinis. *Stylus* demum e tubo stamineo exsertus, ramis connatis conum angustum, usque ad 1,25 mm. longum, circiter 0,4 mm. crassum, pilosum formantibus. (Achenia matura in speciminibus reportatis desunt.)

Xanthium L.

X. spinosum L. — BAKER, l. c. pag. 148.

Pluribi copiosissime occurrit in pascuis et in cultis et civit. Rio Grande do Sul et reipubl. Paraguay. Specimina non reportavimus.

X. strumarium L. — BAKER, l. c. pag. 147.

Aeque ac præcedens pluribi in civit. Rio Grande do Sul et republ. Paraguay. Specimina non reportavimus; forsan in diario nostro cum *X. orientali* L. sit commixtum.

Ambrosia L.

A. tenuifolia SPRENG. — BAKER, l. c. pag. 150.

Paraguay: Asuncion, Recoleta (18 $^{13}/_{2}$ 94. ANISITS 531.).

Icthyothere MART.

I. cunabi MART. — BAKER, l. c. pag. 154.

Matto Grosso: Santa Anna da Chapada (In »cerrado» sat denso, graminoso. 18 $^{19}/_{2}$ et $^{9}/_{3}$ 94. MALME 1404.).

Squamæ involucri albæ.

Polymnia L.

P. silphioides DC. — BAKER, l. c. pag. 159.

Rio Grande do Sul: colonia Ijuhy (In »roças» vetustis; locis graminosis. 18 $^{30}/_{3}$ 93. MALME, 738.).

Herba perennis (haud annua, ut sæpe indicatur).

Acanthospermum SCHRANK.

A. xanthioides (H. B. K.) DC. — BAKER, l. c. pag. 162. — Secundum leges prioritatis forsan melius *A. australe* (L.) OK. nuncupandum sit.

Rio Grande do Sul: Porto Alegre (Locis arenosis, terra ± denudata; nec non in viis oppidi. 18 $^{7}/_{11}$ 92. MALME 276.).

A. hispidum DC. — BAKER, l. c. pag. 163.

Matto Grosso: Cuyabá (Ruderalis, in viis oppidi. 18 $^{26}/_{12}$ 93. MALME 1266.); **Paraguay**: Asuncion (Ruderalis nec non in pascuis apricis pr. urbem. 18 $^{13}/_{7}$ 93. MALME 830.).

Parthenium L.

P. hysterophorus L. — BAKER, l. c. pag. 165.

Argentina: ad Ñacurutú in delta flum. Paraná (1895. KULLBERG.).

Jægeria H. B. K.

J. hirta (LAG.) LESS. — BAKER, l. c. pag. 167.

Rio Grande do Sul: pluribi in apertis humidis, breviter graminosis, in ripis rivulorum et ad margines paludum; specimina reportavimus e colonia Ijuhy (18 $^{5}/_{4}$ 93. MALME 760 B.), Cruz Alta (18 $^{12}/_{4}$ 93. MALME 724 C.), inter Silveira Martins et Cruz Alta (18 $^{24}/_{3}$ 93. MALME 724.).

Enhydra LOUR.

E. anagallis GARDN. — BAKER, l. c. pag. 169.

Rio Grande do Sul: Porto Alegre (In fossis et lacunis. 18 $^{7}/_{11}$ 92. MALME 278.); **Paraguay**: Asuncion (In ripa flum. Paraguay. 18 $^{28}/_{11}$ 93. ANISITS 127.).

Eclipta L.

E. alba (L.) HASSK. — BAKER, l. c. pag. 170.

Rio Grande do Sul: Cachoeira [In campo; in fossa fere sicca. 18 $^{16}/_{2}$ 93. MALME 580. — Forma *erecta* (L.)].

Herba annua, ligulis albis.

E. lanceolata DC. var. **longifolia** BAKER. — BAKER, l. c. pag. 171.

Rio Grande do Sul: Canôas pr. Porto Alegre (Locis subhumidis secundum viam ferream, parce. 18 $^{10}/_{11}$ 92. MALME 294.).

Herba annua (?), ligulis luteis.

E. elliptica DC. — BAKER, l. c. pag. 171.

Rio Grande do Sul: São José del Norte pr. oppid. Rio Grande (Locis humidis, ± graminosis. 18 $^{22}/_{11}$ 92. MALME 324.).

Herba perennis caulibus sæpe decumbentibus, ligulis albis (haud luteis, ut sæpe indicatur); hibernat stolonibus epigæis, foliosis.

Wulffia Neck.

W. stenoglossa (Cass.) DC. — Baker, l. c. pag. 173.

Forsan melius *W. baccata* (L. fil.) OK. nominanda sit.

Matto Grosso: Coxipó (igreja) pr. Cuyabá (In »cerrado» arenoso, alte graminoso. 18 $^{27}/_{12}$ 93. Malme 1278.), Cuyabá (In »cerrado», loco sat glareoso, parce graminoso. 18 $^{13}/_{1}$ 94. Malme 1278 *γ*. — 18 $^{4}/_{2}$ 94. Malme 1278 *β*.).

Species, ut videtur, valde protea. Planta in viciniis oppidi Cuyabá haud rara est herba perennis (v. suffrutex) erecta, usque ad 1 m. alta, subsimplex v. ramosa; caule apicem versus ramisque obtuse tetragonis, pilis adpressis scabris, internodiis 5—8 cm. longis; foliis petiolatis (petiolo circiter 8 mm. longo), ovato-lanceolatis, maximis circiter 8 cm. longis, 3,5 cm. latis, basi cuneatis, apice acuminatis, rarius acutis, argute serratis, supra pilis adpressis verrucisque scabris, subtus præsertim ad nervos pilosis v. scabris; ligulis angustis, luteis.

Blainvillea Cass.

B. rhomboidea Cass. — Baker, l. c. pag. 175.

Bahia: pr. urbem Bahia (Ad viam; loco aperto, argillaceo-arenoso. 18 $^{10}/_{10}$ 94. Malme 1802. Fere omnino deflorata.).

B. biaristata DC. — Baker, l. c. pag. 176.

Rio Grande do Sul: Porto Alegre (Inter frutices arboresque; loco sat umbroso. 18 $^{29}/_{9}$ 92. Malme 92.), Canôas pr. Porto Alegre (Ad viam ferream, in silva; loco sat aperto, terra denudata. 18 $^{10}/_{11}$ 92. Malme 92 B.), Santo Angelo pr. Cachoeira (Ruderalis et in »capoeiras» vetustis. 18 $^{20}/_{1}$ 93. Malme 512 B.).

Herba perennis.

Zinnia L.

Z. multiflora L. — Baker, l. c. pag. 178.

Matto Grosso: Santa Anna da Chapada (Ruderalis. 18 $^{20}/_{2}$ 94. Malme 1410 C.).

Z. elegans Jacq. culta in horto publico oppidi Cuyabá.

Wedelia Jacq.

W. macrodonta DC. — Baker, l. c. pag. 184.

Matto Grosso: Coxipó Mirim (igreja) pr. Cuyabá (In »cerrado»; loco arenoso, sicco. 18 $^{27}/_{12}$ 93. Malme 1278 C.), Cuyabá (18 $^{4}/_{2}$ 94. Malme 1278 C*.).

Ligulæ albæ.

W. brachycarpa Baker. — Baker, l. c. pag. 181.

Paraguay: ad Rio Mbopy (brach. flum. Paraguay) inter Rosario et Asuncion (In margine silvulæ; loco subhumido, parce graminoso. 18 $^{12}/_{9}$ 93. Malme 932.), Colonia Risso pr. Rio Apa (Ruderalis. 18 $^{6}/_{10}$ 93. Malme 932*.).

Specimina originalia hujus speciei non vidimus, at planta a nobis collecta ad descriptionem l. c. datam et ad adnotationes clarissimi Morong (Annals N. Y. Acad. sci., VII, Dec. 1892, pag. 147) bene quadrat; cum *W. Gaudichaudii* DC. est conferenda. In speciminibus nostris achenia nondum sunt evoluta.

Aspilia Thouars.

A. foliacea (Spreng.) Baker. — Baker, l. c. pag. 193.

Minas Geraes: São João del Rey (In campo arenoso-glareoso, aprico, tenuiter graminoso. 18 $^{31}/_{8}$ 92. Malme 12 C.).

A. setosa Griseb. — Baker, l. c. pag. 195.

Rio Grande do Sul: pluribi in vicinitate oppidi Porto Alegre (In campis arenosis, apricis. 18 $^{17}/_{9}$ 92. Malme 32.); **Paraguay**: Colonia Risso pr. Rio Apa (In campo argillaceo-arenoso, graminoso; vulgo ad nidos termitum. 18 $^{20}/_{10}$ 93. Malme 1082 C.).

A. leucoglossa Malme n. sp.

Ic.: tab. nostr. V fig. 15.

Herba perennis circiter 30 cm. alta, rhizomate brevissimo »radicem multicipitem» incrassatam, lignosam formante. *Caules* simplices v. superne parcissime ramosi, erecti, teretes, striati, pilis patentissimis, longis brevioribusve, inferne vulgo sat raris, superne præsertim ad nodos densis scabri, usque ad apicem foliati. *Folia* opposita, 4—5-juga, distantia (internodiis vulgo 5—6, rarius usque ad 7 cm. longis), erecto-patentia, sessilia, et supra et subtus viridia pilisque brevibus scaberrima, trinervia v. indistincte quinquenervia, venis manifestis, inferiora oblongo-lanceolata, integerrima, parva, 1.5—2,5(—3) cm. longa, 4—9 mm. lata, cetera ovato-lanceolata, acuta v. paullulum acuminata, haud profunde serrato-dentata, majora 5—8 cm. longa, 2,5—3,5 cm. lata. *Acladium* (pedunculus) 3,5—5,5 cm. longum, indumento caulis. *Calathidium* heterogamum. *Involucri squamæ* vulgo circiter 12, manifeste biseriatæ, late lanceolatæ, acutæ, exteriores longiores, vulgo 15—20(—23) mm. longæ, 6—8 mm. latæ, et supra et subtus pilosæ, interiores breviores, 12—15(—17) mm. longæ, vulgo solummodo dorso (subtus) pilosæ. *Ligulæ* albæ, sat paucæ, (cum ovario rudimentario) usque ad 22 mm. longæ; ovario rudimentario circiter 2,5 mm. longo, manifeste piloso, aristis 4 pilosis, usque ad 1,5 mm. longis ornato; tubo brevi, vix 3 mm. longo, cylindraceo, glabro; limbo late oblongo, usque ad 8 mm. lato, glabro, apice bidentato v. emarginato. *Paleæ* disci lanceolatæ v. oblongo-lanceolatæ, longe acuminatæ, glabræ, margine apicem versus fimbriato-ciliatæ, manifeste alato-carinatæ. *Flores disci* numerosissimi, usque ad 11 mm. longi; ovario subcylindraceo v. ± manifeste 4-costato, pilis longis, adpressis, sat densis sericeo, aristis 4 sat brevibus, pilosis squamel-

lisque intermediis, brevissimis, laceratis, pilosis ornato; tubi glabri parte tertia inferiore cylindracea, parte superiore sensim paullulum dilatata; dentibus s. lobis limbi erectis, ovato-triangularibus, acutis, circiter 0,8 mm. longis, 0,6 mm. latis, intus præsertim marginem versus dense longepapillosis, extus glabris. *Stamina* exserta, filamentis circiter 3 mm. longis, antheris vix 2,5 mm. longis, appendicibus apicalibus, late ovato triangularibus, obtusiusculis, circiter 0,4 mm. longis, 0,33 mm. latis, subhyalinis. *Stylus* e tubo stamineo demum longe exsertus, ramis filiformibus, demum recurvatis, acutis, apice barbatis. *Achenia* marginis disci fere obovoidea, truncata, paullulum compressa, indistincte bicostata, circiter 4,5 mm. longa, centri inflato-clavata, 4-costata v. subtetragona, usque ad 6 mm. longa, omnia pilosa, subsericea, pappo parvo, cupuliformi, aristis vulgo 4 pilosis, brevibus, sæpe inæquilongis, squamellisque intermediis, minutissimis ornata.

Matto Grosso: Cuyabá (In »cerrado» minus denso; loco subaperto, arenoso-glareoso, sicco. 18 $^{24}/_{11}$ 93. MALME 1160.).

Ligulis albis facillime distincta; *Aspiliæ Burchellii* BAKER affinis, abs qua jam foliis numerosioribus, multo majoribus differt.

A. silphioides (HOOK. & ARN.) BAKER. — BAKER, l. c. pag. 197.

Ic.: tab. nostr. VII fig. 19.

Paraguay: territor. El Gran Chaco, ad Pilcomayo (In »barrancas» fluvii nec non in silva minus densa. 18 $^{4}/_{9}$ 93. MALME 904.).

Specimina authentica hujus speciei non vidimus. Annua esse l. c. indicatur; at nostra planta est herba perennis (v. suffrutex), ceterum ad descriptionem bene quadrat. Achenia in speciminibus reportatis desunt.

A. latissima MALME n. sp.

Ic.: tab. nostr. V fig. 16.

Herba perennis (v. frutex?) usque ad 1,5 m. alta, parce ramosa. *Caulis* erectus, crassus, teres, junior pilis basi verrucæformibus, crassis, brevibus, rigidis, ± adpressis scaberrimus, usque ad apicem foliatus. *Folia* opposita, in caule distantia, internodiis 6—8 cm. longis, in ramis ± conferta, internodiis (0,5—)1—2 cm. longis, petiolata, petiolo 1—2(—2,5) cm. longo, late ovata v. ovali-ovata, basi nonnumquam subcordata, majora usque ad 10—12 cm. longa, vulgo 6—7 cm. lata, in petiolum paullulum decurrentia, apice acuta v. breviter acuminata, inæqualiter serrata, basin versus duplicato-serrata, et supra et subtus pilis brevibus, ± adpressis scaberrima, pinnato-triplinervia, nervis secundariis infimis nervo primario subæquantibus, nervos tertiarios ceteris secundariis subæquantes sub marginem folii emittentibus; venis reticulatis, subtus emersis. *Calathidia* terminalia, 1—3-na, pedunculis 3—4 cm. longis, pro rata gracilibus, pilis crebris scaberrimis, heterogama, multiflora. *Involucri* late campanulati *squamæ* 15—20, indistincte bi—triseriatæ, subæquilongæ, 10—12 mm. longæ, circiter 4 mm. latæ, exteriores late lineares, interiores lingulatæ, omnes apice deltoideæ, acutæ v. brevissime acuminatæ, haud hyalino-marginatæ, margine et dorso (interiores solummodo parte dimidia superiore) dense pilosæ. *Paleæ*

receptaculi usque ad 11 mm. longæ, angustæ (explanatæ vix 2 mm. latæ), lineares, (apice excepto) complicatæ carinatæque, carina marginibusque eciliatis, apice plano, ecarinato, ovato-triangulari, acuto, ciliato, circiter 2 mm. longo, 1,5 mm. lato. *Ligulæ* sat paucæ, uniseriatæ, luteæ, (ovario rudimentario excepto) 2,5—3 cm. longæ; tubo circiter 3 mm. longo, subcylindraceo v. apicem versus paullulum dilatato, parte dimidia superiore pilis longis, mollibus, multiarticulatis parce ornato; limbo oblongo-elliptico, glaberrimo, 8—10 mm. lato, apice rotundato v. indistincte emarginato. *Flores disci* numerosissimi, (cum ovario) usque ad 13 mm. longi; ovario subcylindraceo v. lineari, circiter 4 mm. longo, pilis brevibus, gracilibus, erectis, sat adpressis sericeo, pappo cyathiformi, aristis 2 vix 1 mm. longis subulatis squamulisque minutissimis, lacerato-ciliatis coronato; tubo medio pilis mollibus parce vestito, ceterum glabro, parte dimidia inferiore gracili, cylindracea, superiore manifeste crassiore, apicem versus sensim paullulum dilatata; limbi dentibus s. lobis erectis, triangularibus v. ovato-triangularibus, acutis, circiter 0,9 mm. longis, circiter 0,7 latis, extus glabris, intus longe papillosis. *Stamina* haud multum exserta, filamentis brevibus, vulgo 1—1,5 mm. longis, antheris circiter 2,5 mm. longis, basi brevissime sagittatis, appendicibus apicalibus late cordato-triangularibus, acutis, circiter 0,33 mm. longis, 0,4 mm. latis. *Stylus* e tubo antherarum demum longe exsertus, ramis longis, filiformibus, appendicibus brevibus, acutis, valde barbatis. (Achenia matura in speciminibus reportatis desunt.)

Paraguay: ad ostium fluvii Rio La Paz, in ripa flum. Paraguay (Inter gramina aquatica et frutices ripæ. 18 $^{20}/_{9}$ 93. MALME 964.).

Species distinctissima, nulli arcte affinis, indumento scaberrimo foliisque latis facile dignoscenda.

Oyedæa DC.

O. ovata (GARDN.) BENTH. — BAKER, l. c. pag. 207.

Matto Grosso: Cuyabá (Locis apertis, siccis, arenoso-glareosis, parce graminosis. 18 $^{16}/_{12}$ 93. MALME 1236. 18 $^{3}/_{1}$ 94. MALME 1236*.).

Verbesina L.

V. sordescens DC. — BAKER, l. c. pag. 214.

Rio Grande do Sul: Cachoeira (Ruderalis. 18 $^{23}/_{2}$ 93. MALME 646.), Rincão dos Valles pr. Cruz Alta (Loco subhumido, graminoso, aperto, ad marginem silvæ. 18 $^{20}/_{4}$ 93. MALME 794 C.).

Herba perennis usque ad 1 m. alta.

V. australis (HOOK. & ARN.) BAKER. — BAKER, l. c. pag. 215.

Argentina: Diamante civit. Entrerios (18 $^{27}/_{6}$ 93. MALME.).

Non nisi folia, calathidia deflorata, achenia reportata. In foliis crescit *Puccinia Verbesinæ* SCHWEIN. (MALME Fung. 801.).

Viguiera H. B. K.

V. pilosa BAKER. — BAKER, l. c. pag. 223.

Rio Grande do Sul: Rincão dos Valles pr. Cruz Alta (In pascuo humido, graminoso, ad marginem silvæ. 18 $^{20}/_{4}$ 93. MALME 794.).

Radices incrassatæ, subcarnosæ, fusiformes v. aliquantulum torulosæ.

V. robusta GARDN. — BAKER, l. c. pag. 227.

Matto Grosso: Santa Anna da Chapada, Buriti (Loco aperto, arenoso, sat graminoso. 18 $^{3}/_{6}$ 94. MALME 1658**. 18 $^{15}/_{6}$ 94. MALME 1658.).

V. stenophylla (HOOK. & ARN.) GRISEB. — BAKER, l. c. pag. 221.

Rio Grande do Sul: Rincão dos Valles pr. Cruz Alta (In pascuo arenoso, graminoso, sicco. 18 $^{20}/_{4}$ 93. MALME 794 B.).

Echinocephalum GARDN.

E. latifolium GARDN. — BAKER, l. c. pag. 230.

Paraguay: ad Rio Mbopy (brach. flum. Paraguay) inter Rosario et Asuncion (In fruticetis nec non in marginibus silvularum. 18 $^{12}/_{9}$ 93. MALME 930.).

Spilanthes L.

Nomen *Ceratocephalus* BURM. ante reformatam a LINNÆO nomenclaturam botanicam est conditum, a LINNÆO non adhibitum ideoque non restituendum.

S. arnicoides DC. — BAKER, l. c. pag. 234.

Rio Grande do Sul: Porto Alegre (In campis arenosis, apricis. 18 $^{21}/_{9}$ 92. MALME 80.); **Paraguay:** Asuncion, Villa Morra (18 $^{9}/_{1}$ 94. ANISITS 344.).

Species variabilis. Specimina e Rio Grande do Sul reportata ad genuinam *Sp. arnicoidem* DC. pertinent, paraguayensia magis ad *Sp. sphærocephalam* DC. accedunt.

Sp. macropoda DC. — BAKER, l. c. pag. 234 (*Sp. arnicoides* var. *macropoda* (DC.) BAKER).

Paraguay: El Chaco, in conspectu urbis Asuncion, in campis circa Rio Negro amnem. 18 $^{14}/_{10}$ 93. LINDMAN 2305.).

Sp. leptophylla DC. — BAKER, l. c. pag. 234 (*Sp. arnicoides* var. *leptophylla* (DC.) BAKER).

Rio Grande do Sul: oppidum Rio Grande (Loco aperto, ventoso, arenoso, sat sicco, parce graminoso. 18 $^{19}/_{11}$ 92. MALME 320.).

Isostigma Less.

I. peucedanifolium (Spreng.) Less. — Baker, l. c. pag. 241.

Matto Grosso: Cuyabá (In campo aperto, arenoso-glareoso, sicco. $18^{24}/_{11}$ 93. Malme 1158. — $18^{14}/_{12}$ 93. Malme 1158*.).

Ligulæ atropurpureæ.

I. foliosum Malme n. sp.

Ic.: tab. nostr. VI fig. 17.

Herba 35—50(—65) cm. alta, radice perenni, incrassata, sat carnosa, sæpe nodoso-fusiformi. *Caulis* sæpissime solitarius, erectus v. basi curvatus, sat firmus, teres, striatus v. ± manifeste costatus, glaberrimus, inferne simplex, superne ramosus, tetra—deca-cephalus, usque ad apicem foliatus. *Folia* basalia sat dense rosulata, lineari-oblanceolata, 7—15 cm. longa, 4—7(—9) mm. lata; caulina vulgo numerosa, apicem caulis versus sensim magis magisque distantia (internodiis inferioribus 1—2 cm., superioribus 3—5 cm. longis), descrescentia et in bracteas transeuntia, lanceolata v. lanceolato-linearia (inferiora basalibus subæqualia, media 4—8 cm. longa, 2,5—4,5 mm. lata, superiora sæpe vix 2 cm. longa); omnia semi-amplexicaulia, integerrima, acuta, anguste subhyalino-marginata, glaberrima, parallelinervia, nervis minus conspicuis. *Pedunculi* calathidiorum erecti v. erecto-patentes, vulgo 5—7 cm. longi, sæpe bracteis 2 (rarius 3 v. solitaria) instructi, apice paullulum incrassati. *Calathidia* heterogama. *Involucri* late urceolato-campanulati, 7—8 mm. longi *squamæ* circiter 20 indistincte bi- v. triseriatæ, anguste triangulares, acutæ v. acuminatæ, 5—8 mm. longæ, 2—3 mm. latæ, dorso glabræ, luteo-virides, anguste subhyalino-marginatæ, margine nonnihil lacerato-fimbriatæ levissimeque ciliatæ, apice sæpe paullulum purpurascente. *Paleæ disci* lineari-lanceolatæ v. anguste triangulari-lanceolatæ, 7—8 mm. longæ, 1—1,25 mm. latæ, acutæ, ecarinatæ, apicem versus levissime ciliatæ, ipso apice sæpe purpurascente. *Ligulæ* uniseriatæ, sat paucæ, luteæ, (cum ovario) usque ad 15 mm. longæ; ovario sublineari, circiter 3 mm. longo, circiter 0,66 mm. lato, margine præsertim superne pilis brevibus sat crassis ornato, apice aristis 2, subulatis, circiter 1,5 mm. longis, mox patentibus munito; tubo brevi (circiter 1,5 mm. longo), subcylindraceo, extus glabro; limbo oblongo-elliptico, 4—5 mm. lato, glaberrimo, apice argute et profunde bidentato; stylo longe exserto, ramis longis, gracilibus, filiformibus. *Flores disci* numerosissimi, (cum ovario) vulgo 10—11 mm. longi; ovario 4—5 mm. longo ceterum ut in ligulis; tubi glabri parte tertia inferiore sat gracili, subcylindracea v. superne paullulum constricta, superiore multo crassiore, subcylindraceo v. sursum sensim paullulum dilatato; limbi dentibus s. lobis erectis, circiter 1,5 mm. longis, e basi vix 0,5 mm. lata sensim angustatis, apice obtusiusculis, et extus et intus glabris. *Stamina* e corolla longe exserta, filamentis circiter 3 mm. longis, antheris circiter 2 mm. longis, basi paullulum sagittatis, appendicibus apicalibus ovato-triangularibus, circiter 0,5 mm. longis, vix 0,25 mm. latis. *Stylus* e tubo stamineo longe exsertus, ramis longis, gracilibus, filiformibus. *Achenia* (immatura) sublinearia v. lanceolata, circiter 5 mm. longa, 1 mm. lata, apicem versus ciliata, ceterum glaberrima, nitidula; aristis subulatis, squarrosis, 1—2 mm. longis.

Matto Grosso: inter Morrinho de Santo Antonio et Coxipó (igreja) pr. Cuyabá (In campo aperto, arenoso-glareoso, graminoso, subhumido. 18 $^{26}/_{4}$.94. MALME 1584.), inter Arecá et Coxipó Mirim pr. Cuyabá (18 $^{1}/_{4}$ 94. MALME s. n.).

Distinctissima species, et ligulis luteis et foliis in genere latis cauleque folioso facillime dignota.

Cosmos CAV.

C. caudatus H. B. K. — BAKER, l. c. pag. 242.

Matto Grosso: Buriti par. S:a Anna da Chapada (In »capoeira», ad viam. 18 $^{16}/_{6}$ 94. MALME 1682.).

Ligulæ roseo-violaceæ.

Bidens L.

B. pilosus L. — BAKER, l. c. pag. 244.

Matto Grosso: Santa Anna da Chapada (Ruderalis. 18 $^{20}/_{2}$ 94. MALME 1410 B.).

Galinsoga R. & P.

G. parviflora CAV. — BAKER, l. c. pag. 250.

Rio Grande do Sul: Canôas pr. Porto Alegre (In hortis et agris. 18 $^{10}/_{11}$ 92. MALME 308.).

Calea L.

C. lantanoides GARDN. — BAKER, l. c. pag. 254.

Matto Grosso: Cuyabá (In »cerrado» sat denso, arenoso-glareoso. 18 $^{2\ \&\ 10}/_{4}$ 94. MALME 1526.).

Herba perennis usque ad 1 m. alta.

C. ferruginea SCH. BIP. — BAKER, l. c. pag. 261.

Matto Grosso: Santa Anna da Chapada (In »cerrado» minus denso, lapidoso-arenoso, sicco. 18 $^{22}/_{2}$ 94. MALME 1416.).

Frutex (suffrutex?) pedalis, ramosissimus, obscure viridis.

C. clematidea BAKER. — BAKER, l. c. pag. 262.

Paraguay: Asuncion (Locis siccis; in fruticetis, ad vias etc. 18 $^{13}/_{7}$ 93. MALME 832. — 18 $^{25}/_{7}$ 93. MALME 832 β.), Paraguari (In collibus arenoso-glareosis, apricis. 18 $^{1}/_{8}$ 93. MALME 832 γ.).

Frutex erectus, ramosus, 1—1 $^{1}/_{2}$ m. altus.

C. pinnatifida (R. Br.) Less. — Baker, l. c. pag. 263.

Rio Grande do Sul: Porto Alegre (In fruticetis silvulisque minus densis. 18 $^{3}/_{11}$ 92. Malme 246.).

Frutex (v. suffrutex) alte scandens.

C. uniflora Less. — Baker, l. c. pag. 264.

Rio Grande do Sul: Porto Alegre (In campo arenoso, aprico. 18 $^{21}/_{9}$ 92. Malme 80 B.), Cachoeira (In campo; locis breviter graminosis, sat siccis v. subhumidis. 18 $^{21}/_{2}$ 93. Malme 622.).

»Radix multiceps» incrassata, ± carnosa.

Heleniеæ.

Tagetes L.

T. minuta L. — Baker, Flor. brasiliensis, Fasc. XCIII, pag. 273.

Rio Grande do Sul: ruderalis et in arenosis subhumidis, ± nudis pluribi; specimina reportavimus e São João del Norte (18 $^{22}/_{11}$ 92. Malme 354), oppid. Rio Grande (18 $^{29}/_{11}$ 92. Malme 354 γ.), Cruz Alta (18 $^{17}/_{4}$ 93. Malme 788.).

T. patula L. culta in horto publico oppidi Cuyabá.

Gaillardia Fouger.

G. megapotamica Spreng. var. **scabiosoides** (Arn.) Baker. — Baker, l. c. pag. 277.

Argentinæ civit. **Entrerios**: Diamante (1895. Kullberg.).

Porophyllum Vaill.

P. ruderale (Jacq.) Cass. — Baker, l. c. pag. 282.

Rio Grande do Sul: Silveira Martins pr. Santa Maria (Ruderalis, secundum viam, terra denudata. 18 $^{1}/_{3}$ 93. Malme 664.).

Etiam alibi in Rio Grande do Sul.

Herba annua usque ad 0,75 m. alta; folia maxima longe petiolata (petiolo usque ad 2 cm. longo), 5,5 cm. longa, 2,5 cm. lata, basi cuneata, apice obtusiuscula, breviter mucronulata; involucra angusta, squamis circiter 2 cm. longis, circiter 2,5 mm. latis, acuminatis, pappum superantibus; achenia hirtella, circiter 8 mm. longa, pappo albido, subæquilongo v. paullulo longiore.

Specimina Swartziana ex India occidentali reportata foliis gaudent angustioribus (maximis 4,5 cm. longis, 1,25—1,5 cm. latis), squamis involucri longioribus (usque ad 23 mm. longis), longius acuminatis, pappum paullulo longiorem vulgo superantibus.

Specimina brasiliensia, saltem quæ nobis licuit examinare, pertinent ad f. *intermediam* (DC.) (*P. ellipticum* Cass., *β intermedium* DC.), quæ tamen a *P. ruderali* (Jacq.) haud est distinguenda.

P. ellipticum Cass. contra species distincta esse videtur. Differt foliis pro rata latioribus, longius petiolatis, petiolo laminam longitudine superante; squamis involucri paullulo brevioribus, circiter 18 mm. longis, pappum vulgo haud superantibus; acheniis hirtis, circiter 1 cm. longis, pappo fulvescente, breviore (circiter 8 mm. longo). Ad mexicanum *P. macrocephalum* DC. accedit.

P. macrolepideum Malme n. sp.

Herba perennis usque ad 1 m. alta, glaberrima, parce pruinosa. *Caulis* erectus, teres, striatus, inferne subsimplex v. parce-ramosus, superne ± ramosus, oligocephalus, usque ad apicem foliatus. *Folia* partis dimidiæ inferioris caulis opposita, internodiis 6—8 cm. longis, cetera alterna, internodiis 3—4 cm. longis, omnia manifeste petiolata (petiolo [0,5—]1—1,5 mm. longo), subintegerrima, utrinque acuta, inferiora oblongo-lanceolata, (4—)5—6 cm. longa, 10—15 mm. lata, superiora lineari-lanceolata (4—)5—6(—7) cm. longa, 2—4 mm. lata. *Pedunculi* calathidiorum erecti v. erecto-patentes, vulgo 4—6 cm. longi, apice manifeste incrassati. *Calathidia* multiflora (20—30-flora), circiter 2,5 cm. longa. *Involucri* subcylindracei *squamæ* vulgo 5, lineares, breviter acuminatæ, circiter 2 cm. longæ, 3,5—4 mm. latæ, vulgo late subhyalino-marginatæ, apice deltoideo sæpe paullulum comoso, purpurascente. *Flores* manifeste exserti, atropurpurei, (cum ovario) 2,25—2,5 cm. longi; ovario 9—10 mm. longo, subcylindraceo v. angustissime fusiformi, haud dense piloso; tubo circiter 12 mm. longo, gracili (vix 0,25 mm. crasso), apicem versus paullulum dilatato, tota longitudine extus pilis brevibus, erectis, ± adpressis, cylindraceis v. nonnihil clavatis parce ornato; limbo campanulato, usque ad medium quinquefido, lobis erectis v. patentibus, oblongo-triangularibus, acutis v. breviter acuminatis, circiter 1,25 mm. longis, circiter 0,5 mm. latis, extus præsertim apicem versus pilis brevibus, adpressis, ± clavatis sat parce ornatis. *Stamina* exserta, filamentis circiter 3 mm. longis, antheris 2 mm. longis, basi sagittatis, appendicibus apicalibus triangularibus, acutis, circiter 0,25 mm. longis, vix 0,2 mm. latis. *Stylus* e tubo stamineo haud multum exsertus, ramis longis, gracilibus, filiformibus, acutis, parte superiore (appendice) dense barbatis. *Achenia* (immatura) sat dense sericea, circiter 10 mm. longa, pappo albido subæquilongo.

Matto Grosso: Cuyabá (Juxta viam in »cerrado», pr. oppidum. 18 7/2 94. Malme 1368 B.).

P. ruderali (Jacq.) affine, abs qua differt radice perenni, foliis multo angustioribus, squamis involucri pro rata latioribus etc.

P. lanceolatum DC. — Baker, l. c. pag. 282.

Rio Grande do Sul: inter Cascata de Hermenegilda (in Serra dos Tapes) et oppidum Pelotas (In campo arenoso, aprico. 18 13/12 92. Malme 454 B.).

Herba perennis circiter 40 cm. alta, fere tota pruinosa. Folia crassa, alterna, sparsa, subsessilia v. breviter petiolata, anguste lingulato-lanceolata, indistincte crenata, maxima 4,5 cm. longa, circiter 6 mm. lata, apice subobtusa v. acutiuscula, basi sensim in petiolum decurrentia. Squamæ involucri sublineares v. lingulato-lanceolatæ, apice deltoideæ, ipso apice sæpe brevissime comosæ, 12—14 mm. longæ, latissimæ circiter 3 mm. latæ, interiores late hyalino-marginatæ, pappo multo breviores. Corollæ limbus albus v. dilute flavoviridis, sat indistincte purpurascens. Achenia 7—9 mm. longa, dense hirsuta, pappo paullulo breviore, circiter 7 mm. longo, setis rigidis, basin versus albidis, apicem versus purpurascentibus v. brunneo-purpurascentibus, sat distincte plumosis.

Foliorum forma a speciminibus originalibus aliquantulum recedit nostra planta at specifice vix distinguenda. Icon a BAKER l. c. data neque cum descriptione congruit neque ad specimina a DECANDOLLE commerorata quadrat.

P. linifolium (L.) DC. — BAKER, l. c. pag. 283.

Rio Grande do Sul: Porto Alegre (Pluribi in campo arenoso, sicco, aprico. Octobr. 1892. MALME 120 B.).

Folia anguste linearia, vix 1 mm. lata. Involucri squamæ dorso pruinosæ, late lanceolatæ, acutæ v. acuminatæ, circiter 10 mm. longæ, pappo paullulo breviores. Limbus corollæ ramique styli atropurpurei.

P. brevifolium (HOOK. & ARN.). — BAKER, l. c. pag. 283 (*P. linifolium β brevifolium* (HOOK. & ARN.) BAKER.).

Rio Grande do Sul: Senandes pr. oppidum Rio Grande (In apricis arenosis, parce graminosis. 18 $^{25}/_{11}$ 93. MALME 372.).

Foliis lingulato-lanceolatis, circiter 20 mm. longis, circiter 3 mm. latis, obtusis v. acutiusculis, calathidiis majoribus, involucri squamis lingulato-linearibus, apice deltoideis v. acuminatis, circiter 15 mm. longis, usque ad 4 mm. latis a *P. linifolio* (L.) facile est distinctum. Achenia subglabra, circiter 8 mm. longa, pappo paullulo breviore, circiter 7 mm. longo, sordide albo, apice purpurascente. Corollæ limbus sordide albus v. dilute flavovirens.

P. angustissimum GARDN. — BAKER, l. c. pag. 285.

Matto Grosso: Serra da Chapada (Loco aperto, arenoso, parce graminoso v. in marg. »cerrado». 18 $^{3-24}/_{6}$ 94. MALME 1658 B.).

Saltem sæpe herba annua. Squamarum involucri apices, corolla, rami styli atropurpurei.

Pectis L.

P. stella MALME n. sp.

Ic.: tab. nostr. VI fig. 18.

Herba perennis basi valde ramosa, radice tortuosa, vix v. haud multum incrassata, ramis gracilibus, vix 1 mm. crassis, usque ad 25 cm. longis, decumbentibus, apice ± ad-

scendentibus, parce ramosis, atropurpureis v. purpurascentibus, pubescentibus (vulgo, præsertim in parte superiore internodii, bifarie), usque ad apicem foliatis, mono—oligo-(usque ad 6-)cephalis. *Folia* ± distantia, internodiis inferioribus circiter 0,5 cm., superioribus usque ad 2 cm. longis, adscendentia, opposita, semiamplexicaulia, uninervia, pellucido-punctata, sublinearia v. sensim angustata subulataque, maxima 15—20 mm. longa, 1—1,5 mm. lata, spinuloso-mucronata, margine cartilaginea, usque ad apicem spinuloso-ciliata, spinulis utriusque lateris 6—8, præsertim apicem versus præterea ciliolata, supra et subtus glabra. *Pedunculi* calathidiorum 1—2(—2,5) cm. longi, erecti v. adscendentes, vulgo atropurpurei, circumcirca pubescentes, sub apice sæpe bracteis 2, oppositis, subulatis, circiter 4 mm. longis, stramineis v. ± purpurascentibus, margine dense ciliolatis, haud spinuloso-ciliatis muniti. *Calathidia* (exceptis ligulis) 7—8(—9) mm. longa, heterogama, 15—17-flora. *Involucri* oblongi v. anguste campanulati *squamæ* 5, subæquales, æquilongæ, lanceolatæ v. lanceolato-oblongæ, 6—7 mm. longæ, vix 1,5 mm. latæ, obtusiusculæ, mucronatæ, basin versus obtuse carinatæ, dorso glabræ v. basin versus nonnihil puberulæ, basi parce, apicem versus sat crebre ciliatæ, stramineo-virides, mucrone sæpe purpurascente. *Ligulæ* 5, in anthesi patentissimæ, (cum ovario) circiter 12 mm. longæ; ovario 3 mm. longo, subcylindraceo, sat dense sericeo, sub apice præterea glandulis nonnullis ornato; tubo 2,5—3 mm. longo, sat gracili, cylindraceo, glabro; limbo luteo, dorso præsertim apicem versus purpurascente, glabro, oblongo-lanceolato, circiter 1,5 mm. lato, apice brevissime tridentato, dentibus obtusissimis. Stylus circiter 4 mm. longus, ramis sat longis, linearibus, obtusis. *Flores disci* (cum ovario) circiter 8 mm. longi; ovario 2,5—3 mm. longo, iis florum femin. simili; tubo subcylindraceo v. apicem versus sensim paullulum dilatato, extus glabro; limbi subbilabiati dentibus 5, erectis, obtusis, margine præsertim apicem versus longe papillosis, dorso glandulis solitariis parcissime ornatis, 4 brevibus, lanceolato-oblongis, vix 0,5 mm. longis, circiter 0,2 mm. latis, uno circiter 1,5 mm. longo, lanceolato-lineari, circiter 0,3 mm. lato. *Stamina* persistenter inclusa; antheris circiter 1,5 mm. longis, basi brevissime sagittatis, apice emarginatis. *Stylus* paullulum exsertus, ramis brevissimis v. subnullis. *Achenia* subcylindracea v. anguste clavato-fusiformia, circiter 3 mm. longa, leviter striata, sat parce pilosa, castaneo-nigricantia; pappi fulvoferruginei, 4—5 mm. longi setis circiter 20, inæquilongis, manifeste ciliatis.

Matto Grosso: Coxipó Mirim inter São Jeronymo et Cuyabá (Locis apertis, glareoso-arenosis, subhumidis v. sat siccis, parce graminosis, solo fere denudato. 18 $^{10}/_{2}$ 94. Malme 1394 B. — 18 $^{2}/_{4}$ 94. Malme 1528 B.).

Pectidi Burchellii Baker, cujus speciei descriptione nimis brevi in Flora brasil. illustratæ speciminulum authenticum minutum vidimus, sine dubio arcte affinis; forsan sit ejus subspecies v. varietas. Differt ramis vulgo oligocephalis (haud monocephalis), foliis tota longitudine spinuloso-ciliatis, pappi setis achenium longitudine superantibus etc. De colore ligularum et de limbo florum disci nihil affert celeberr. Baker.

P. jangadensis Spencer Moore. — Sp. Moore, Trans. Linn. Soc. of London, 2nd Ser. Vol. IV, part. 3 (1895), pag. 389.

Matto Grosso: in trajectu fluvii Jangada (In campis nemorosis (»cerrado») solo saxoso etc. 18 12/2 94. Lindman 3023.), Cuyabá (Locis apertis, arenosis, subhumidis. 18 3/5 94. Malme s. n. Fere deflorata.).

Anthemideæ.

Anthemis L.

A. mixta L.

Rio Grande do Sul: oppidum Rio Grande (In viis, ad portum. 18 23/11 92. Malme 356.). Eandem speciem e Rio de Janeiro reportavit celeberr. N. J. Andersson.

Cotula coronopifolia L. — Baker, Flor. brasiliensis, Fasc. XCIII, pag. 291 — in humidis circa oppidum Rio Grande pluribi, at specimina non reportavimus.

Soliva R. & P.

S. anthemidifolia (Juss.) R. Br. — Baker, l. c. pag. 296.

Paraguay: territor. Gran Chaco, ad Pilcomayo (In campo argillaceo; loco subhumido, parce graminoso. 18 7/9 93. Malme 912.).

S. sessilis R. & P. — Baker, l. c. pag. 294.

Rio Grande do Sul: pluribi in vicinitate oppidi Porto Alegre, ubi mensibus Sept. et Oct. florentem observavimus; specimina reportavit Lindman (N:o 441).

Senecioneæ.

Erechthites Rafin.

E. hieraciifolia (L.) Rafin. — Baker, Flor. brasiliensis, Fasc. XCIII, pag. 298.

Rio Grande do Sul: pluribi in »roças» nec non locis humidis campi, ± nudis; specimina reportavimus e colonia Ijuhy (18 1/4 93. Malme 746.), Cruz Alta (18 12/4 93. Malme 746 β et γ.), São Martinho pr. Santa Maria (18 25/4 93. Malme 826 G.).

Quoad indumentum nonnihil variat, at variationes vix propriis nominibus dignæ sunt.

E. valerianæfolia (Wolf) DC. — Baker, l. c. pag. 300.

Rio Grande do Sul: pluribi in »roças» etc. copiosissima: specimina reportavimus e Canôas pr. Porto Alegre (18 10/11 92. Malme 298.), colonia Ijuhy (18 3/4 93. Malme 750.).

In uliginosis graminosis camporum civitat. Rio Grande do Sul passim occurrit hujus speciei forma foliis angustioribus, inferioribus et sæpe mediis integris, serrato-dentatis, caule parce piloso, calathidiis majoribus, apicibus squamarum involucri æque ac pappo violaceo-purpurascentibus recedens. Specimina reportavimus e Cruz Alta (18 $^{12}/_{4}$ 93. MALME 776.). Loco natali ulterius examinanda!

E. missionum MALME n. sp.

Herba annua glaberrima, usque ad 1 m. alta. *Caulis* erectus, firmus, usque ad 8 mm. crassus, teres, striatus v. sulcatus, inferne simplex, superne ± ramosus, usque ad apicem foliatus. *Folia* alterna, sat distantia, internodiis vulgo 3—6 cm. longis, breviter petiolata, petiolo vulgo 1—3 cm. longo, oblongo-elliptica v. elliptica v. rarius ovato-oblonga, apice acuta, basi cuneata et in petiolum paullulum decurrentia, crebre at haud profunde serrato-dentata (superiora nonnumquam basin versus profundius dentata), et supra et subtus obscure viridia, majora 14—17 cm. longa, 6—7(—8) cm. lata, nervis secundariis utroque latere 14—18, rectis, angulo semirecto insidentibus. *Inflorescentia* corymbosa, sat ampla densaque, pedicellis calathidiorum patentibus, sæpe curvulis, valde inæquilongis, (0,5—)1—2(—4) cm. longis, sæpe bractea solitaria filiformi ornatis. *Calathidia* vulgo 13—14 mm. longa, multiflora. *Involucri* cylindracei, glabri *squamæ* interiores 12—15, æquilongæ, lineares, acutæ, albohyalino-marginatæ, vix 1 mm. latæ, exteriores 6—8, vulgo circiter 3 mm. longæ, angustissimæ, filiformes. *Flores* numerosissimi (circiter 50), luteo-virides, subæquilongi, (cum ovario) 12—13 mm. longi, marginem disci versus feminei, ceteri hermaphroditici; ovario circiter 1 mm. longo, subcylindraceo v. nonnihil fusiformi, pilis crebris, brevibus, adpressis sericeo; tubo gracili (circiter 0,25 mm. crasso), filiformi, glaberrimo, in floribus hermaphroditicis apicem versus manifeste dilatato, in femineis vix v. haud multum dilatato; limbi dentibus s. lobis 5, erectis, ovato-triangularibus, acutiusculis, in floribus hermaphroditicis circiter 0,5 mm. longis, circiter 0,33 mm. latis (in femineis paullulo minoribus), extus glabris, intus marginem versus papillosis, ceterum glabris. *Stamina* in corolla persistenter inclusa, antheris vix 1 mm. longis, basi obtusis, appendicibus apicalibus minutis, sublinearibus, obtusis, vix 0,15 mm. longis. *Stylus* demum exsertus, ramis brevibus, obtusis, sub apice nonnihil barbatis. *Achenia* 10-costata, oblonga v. subellipsoidea, circiter 2 mm. longa, castanea v. fulvo-castanea, inter costas sat parce sericea, pappo 12—13 mm. longo, molli, niveo, demum caduco.

Rio Grande do Sul: Colonia Ijuhy (In »roças», agris combustis, nec non juxta vias in silva, solo ± denudato. 18 $^{1}/_{4}$ 93. MALME 744.).

Affinis *E. hieraciifoliæ* (L.) RAFIN., abs qua jam caule glaberrimo foliisque multo latioribus, integris facile distinguenda.

Senecio L.

S. crassiflorus (LAM.) DC. var. **tricuspis** BAKER. — BAKER, l. c. pag. 308.

Rio Grande do Sul: oppidum Rio Grande (Loco arenoso, sat sicco, fere nudo. 18 $^{19}/_{11}$ 92. MALME 318.). — Rhizoma subterraneum horizontale.

F. maritima: foliis subintegerrimis, crassis, carnosis, anguste lanceolatis v. lingulato-lanceolatis, 4—5 cm. longis, circiter 6 mm. latis.

Rio Grande do Sul: Estação balnear pr. oppid. Rio Grande (In arena mobili litoris Oceani. 18 $^{20}/_{11}$ 92. MALME 318 B.).

S. heterotrichius DC. — BAKER, l. c. pag. 311.

Rio Grande do Sul: Porto Alegre (Locis arenosis, ± siccis; sæpe in fruticetis minus densis. 18 $^{14}/_{10}$ 92. MALME 174.).

Suffrutex usque ad 1 m. altus.

S. icoglossus DC. — BAKER, l. c. pag. 316.

Rio Grande do Sul: passim in Campos da Cima da Serra; specimina collegimus inter Cruz Alta et Rincão dos Valles (In campo humido, breviter graminoso. 18 $^{19}/_{4}$ 93. MALME 790.).

S. Balansæ BAKER. — BAKER, l. c. pag. 317.

Paraguay: Asuncion (Ruderalis et in pascuis siccis. 18 ^{15} & $^{20}/_{7}$ 93. MALME 844.), territor. Gran Chaco, ad Pilcomayo (In »barrancas» fluvii. 18 $^{4}/_{9}$ 93. MALME 910.).

Herba perennis (v. suffrutex) $^{1}/_{2}$—$^{2}/_{3}$ m. alta.

Cum *S. Grisebachii* BAKER est conferendus.

S. Benthami GRISEB. — BAKER, l. c. pag. 318.

Paraguay: pluribi in marginibus silvarum et in fructicetis minus densis, humidis; specimina reportavimus ex Asuncion (18 $^{18}/_{8}$ 93. MALME 880.), territor. Gran Chaco, ad Pilcomayo (18 $^{6}/_{9}$ 93. MALME 880 *β*.), Rio Mbopy inter Rosario et Asuncion (18 $^{11}/_{9}$ 93. MALME 880 *γ*.).

Herba volubilis (v. sarmentosa), calathidiis speciosis, ligulis purpureis v. subminiatis, floribus disci primum aurantiacis, dein purpurascentibus.

S. brasiliensis (SPRENG.) LESS. — BAKER, l. c. pag. 322.

Rio Grande do Sul: pluribi; specimina reportavimus e Porto Alegre (18 $^{3}/_{11}$ 92. MALME 262.).

S. pinnatus POIR. var. leptolobus (DC.) BAKER. — BAKER, l. c. pag. 323.

Rio Grande do Sul: Cachoeira (In campo aprico. 18 $^{11}/_{5}$ 93. MALME 810.), Porto Alegre (In campo arenoso, sat sicco apricoque. 18 $^{14}/_{10}$ 92. MALME 168.).

Suffrutex $^{1}/_{3}$—$^{1}/_{2}$ m. altus, sat parce ramosus.

Cichorieæ.

Hypochæris L.

H. Gardneri (Sch. Bip.) Baker. — Baker, Flor. brasiliensis, Fasc. XCIII, pag. 331.

Rio Grande do Sul: Cachoeira (In campo; loco humido, breviter graminoso. 18 21/2 93. Malme 618.), pr. São Martinho pr. Santa Maria (In palude breviter graminosa. 18 25/4 93. Malme 800 B.).

In vicinitate oppidi Caldas, ubi haud rara, variis mensibus a Widgren, Regnell, Lindberg, Mosén collecta est.

H. brasiliensis (Less.) Griseb. — Baker, l. c. pag. 333.

Rio Grande do Sul: locis subhumidis ruderalis, pluribi; specimina reportavimus ex oppid. Rio Grande (18 27/11 92. Malme s. n.), Silveira Martins pr. Santa Maria (18 5/3 93. Malme s. n.).

Lactuca L.

L. virosa L.

Rio Grande do Sul: Silveira Martins pr. Santa Maria (Inquilina in cultis et ad vias. 18 /3 93. Malme 826 I.).

Sonchus L.

S. oleraceus L. — Baker, l. c. pag. 335.

Rio Grande do Sul: in cultis pluribi, ex. gr. Porto Alegre, col. Ijuhy.
Specimina non reportavimus.

S. asper (L.) All. — Baker, l. c. pag. 335.

Rio Grande do Sul: in cultis pluribi, ex. gr. col. Silveira Martins, oppidum Rio Grande.
Specimina non reportavimus.

Taraxacum L.

T. officinale Web. apud Wigg.

E diario nostro copiose in pascuis siccis ad Silveira Martins civit. Rio Grande do Sul, at specimina non reportavimus.

Hieracium L.

H. Commersonii Monn. — Baker, l. c. pag. 237.

Rio Grande do Sul: Novo Hamburgo, Hamburgerberg (Locis arenosis, sat siccis, antea cultis. 18 $^{27}/_{10}$ 92. Malme 238.), Cachoeira (In declivibus collium campi apricis, parce graminosis. 18 $^{16}/_{2}$ 93. Malme 584.).

Specimina e Novo Hamburgo reportata, in solo fertiliore nata, caule robustiore, usque ad 1 m. alto, foliis basalibus (cum petiolo) usque ad 25(—30) cm. longis, usque ad 4(—5) cm. latis recedunt, at ceterum cum speciminibus ad Cachoeira lectis plane congruunt.

E Cachoeira præterea reportavimus specimina duo habitu *Hieracio Commersonii* Monn. simillima at foliis repando-denticulatis, supra parce, subtus sat dense floccosis, caule inferne dense floccoso, involucro densissime floccoso, glandulis paucioribus minoribusque recedentia; nominanda var. **megapotamicum** Malme.

Mutisieæ.

Moquinia DC.

M. polymorpha (Less.) DC. — Baker, Flor. brasiliensis, Fasc. XCIII, pag. 345.

Var. **obtusifolia** (Less.) DC.

Rio Grande do Sul: Santo Angelo pr. Cachoeira (Solitaria in campo subhumido nec non in margine silvæ. 18 $^{21}/_{1}$ 93. Malme 518.).

Arbor usque ad 8 m. alta, cortice sat crasso, rimoso.

M. mollissima Malme n. sp.

Frutex circiter 0,5 m. altus, gregatim crescens, basi ramosus, ramis erectis, subsimplicibus, usque ad 4 mm. crassis, teretibus, leviter costatis, præsertim superne densissime albo-tomentosis, usque ad apicem dense foliatis, internodiis 1—2 cm. longis. *Folia* sparsa, brevissime petiolata (petiolo 1—2 mm. longo) v. subsessilia, ovalia v. ovata v. late ellipsoidea, 5—6(—7) cm. longa, (2,5—)3—3,5(—4) cm. lata, basi rotundata, apice obtusa et minute mucronata, integerrima, supra dense at brevissime cinereo-tomentosa, subtus densissime albido-tomentosa, nervis supra nonnihil immersis, subtus emersis, secundariis utroque latere vulgo 5—6, venis reticulatis, subtus prominentibus junctis. *Inflorescentia* corymboso-paniculata, sat contracta, pedicellis calathidiorum vulgo circiter 0,5 cm. longis. *Calathidia* 15—20-flora. *Involucri* late campanulati, 8—9 mm. longi *squamæ* numerosæ (20—25), in pedicellum haud decurrentes, valde inæquilongæ, circiter 4-seriatæ, dorso tomentosæ, late subhyalino-marginatæ, margine dense fimbriato-ciliatæ, ± acuminatæ,

exteriores triangulares, 3—4 mm. longæ, 2—2,5 mm. latæ, mediæ lanceolato-triangulares, 5—6 mm. longæ, 1,75—2,25 mm. latæ, interiores (superiores) lanceolatæ, 7—8 mm. longæ, 1,25—1,75 mm. latæ. *Flores* cum ovario 12 cm. longi; ovario subcylindraceo, circiter 4 mm. longo, sericeo; tubo subcylindraceo, 2,5—3 mm. longo, sat crasso, extus glabro; limbi albidi laciniis linearibus, circiter 5 mm. longis, circiter 0,5 mm. latis, obtusiusculis, supra et subtus glabris, sæpissime demum revolutis. *Stamina* (in floribus examinatis sterilia) apices laciniarum limbi haud superantia, antheris circiter 3 mm. longis, apice hyalino-appendiculatis, acuminatis, basi profunde sagittatis, caudis longis barbatisque. *Stylus* e tubo stamineo longe exsertus, 9—10 mm. longus, ramis brevissimis, vix 0,5 mm. longis, obtusis. *Achenia* (immatura) usque ad 4 mm. longa, pappi 7—8 mm. longi, fulvo-rubescentis setis numerosis (ad 100), manifeste ciliatis.

Rio Grande do Sul: Cachoeira (In campo sicco, aprico; parce. 18 $^{24}/_{2}$ 93. MALME 648.).

Moquiniæ polymorphæ (LESS.), speciei sine dubio collectivæ, ut dicunt, affinis, at jam foliorum forma indumentoque et calathidiis majoribus differt.

Chuquiragua JUSS.

Ch. glabra (SPRENG.) BAKER. — BAKER, l. c. pag. 363. — *Ch. brasiliensis* (SPRENG.) OK.

Matto Grosso: Corumbá (In silva minus densa regionis calcareæ. 18 $^{26}/_{7}$ 94. MALME 1770.); **Rio Grande do Sul**: Cruz Alta (In »capão». 18 $^{14}/_{4}$ 93. MALME 782. Flores nondum bene evoluti.); **Paraguay**: Paraguari (In silva ad radices montis Cerro Negro, loco sat aperto. 18 $^{5}/_{8}$ 93. MALME 870.).

Frutex ramosissimus, subscandens, usque ad 4 m. altus.

Ch. mattogrossensis MALME n. sp.

Frutex usque ad 1 m. altus, parce ramosus. *Rami* ± erecti, glabri, purpurascentes, circiter 3 mm. crassi, internodiis vulgo 2—3 cm. longis. *Folia* brevissime petiolata (petiolo 1—2 mm. longo), elliptica v. raro ovato-elliptica, acuta v. obtusiuscula, raro spinoso-mucronulata, et supra et subtus glabra, media 7—8 cm. longa, circiter 4 cm. lata, e basi trinervia (rarissime indistincte 5-nervia), venis sat paucis, subtus paullulum emersis; spinæ axillares rectæ v. decurvatæ, circiter 4 mm. longæ, sæpe omnino deficientes. *Calathidia* in apicibus ramulorum usque ad 10 cm. longorum (quam rami) densius foliatorum (internodiis 1,5—2 cm. longis) solitaria, 45—50-flora. *Involucrum* campanulatum, 3—3,5 cm. longum, squamis inferioribus (exterioribus) late ovalibus v. ovatis, obtusissimis, usque ad 5 mm. latis, stramineo-fulvescentibus, dorso nitidis glaberrimisque v. marginem versus indistincte sericeis, margine vulgo lacerato-ciliatis, mediis anguste oblongis, circiter 1,5 cm. longis, circiter 5 mm. latis, obtusis v. acutiusculis, stramineis, dorso fere tota longitudine sericeo-pubescentibus, margine ciliatis, superioribus lanceolato-linearibus, circiter 2,5 cm. longis, 3—4 mm. latis, summis (intimis) linearibus, acutis, usque ad 3 cm. longis, 1,5—2 mm. latis, æque ac superioribus dorso sericeo-pubescentibus ciliatisque.

Corollæ tubus cylindraceus, circiter 9 mm. longus extus glaber, intus pilis longis, albis, mollibus usque ad faucem vestitus, limbus albus, 11—12 mm. longus, circiter 3,5 mm. latus, intus (supra) et extus (subtus) glaber, exceptis lobis vix 3 mm. longis, extus præsertim apice pilis longis albis, mollibus, sat densis ornatis. *Antheræ* generis, circiter 8 mm. longæ. *Stylus* antheras longe superans. *Achenia* immatura circiter 6 mm. longa, longe denseque albidosericea; pappi setæ vulgo 16—20, circiter 18 mm. longæ, albæ, manifeste plumosæ.

Matto Grosso: Arecá pr. Cuyabá (In »cerrado» minus denso; loco arenoso, alte graminoso. 18 $^{2}/_{6}$ 94. Malme 1646.).

A *Ch. chapadensi* S. Moore, quæ non nisi e descriptione in Transact. Linn. Soc. of London, 2nd Ser. Vol. IV, Part. 3, pag. 389 data mihi cognita est, foliis pro rata latioribus, calathidiis solitariis majoribusque etc. differt. In *Ch. fodinarum* (Gardn.) Baker, nostræ speciei affini, e descriptione folia angustiora, apice spinoso-mucronata, calathidia 30-flora, squamæ involucri brunneæ, pappus brunneus, pro rata brevior.

Barnadesia Mutis.

B. rosea Lindl. — Baker, l. c. pag. 364.

Matto Grosso: Serra da Chapada (Inter frutices, in declivibus montis, ad viam inter Santa Anna da Chapada et Cuyabá. 18 $^{2}/_{6}$—$^{22}/_{6}$ 94. Malme 1648.).

Mutisia L. fil.

M. coccinea S:t Hil. — Baker, l. c. pag. 366.

Rio Grande do Sul: Hamburgerberg (Scandens in fruticeto; loco subhumido. 18 $^{20}/_{10}$ 92. Malme 192.), Porto Alegre (18 $^{3}/_{11}$ 92. Malme 192 *β*.).

Ligulæ purpureæ.

Huc pertinent Widgren 246 (Minas Geraes: loco haud indicato. 1845.), Regnell I: 199* (Minas Geraes: Caldas. 18 /$_{2}$ 62, 18 $^{15}/_{8}$ 64, 18 $^{10}/_{6}$ 69.), Mosén 611 (In eadem regione, in silva campi, ad rivulum. 18 $^{1}/_{10}$ 73.), Lindberg 25 (São Paulo: loco haud indicato. 18 /$_{4}$ 54.).

M. campanulata Less. — Baker, l. c. pag. 367.

Rio Grande do Sul: Cascata de Hermenegilda pr. oppid. Pelotas (Scandens in fruticeto; loco subhumido. 18 $^{13}/_{12}$ 92. Malme 454.).

Ligulæ rubræ v. subminiatæ.

Specimina Lindbergiana, Widgreniana, Regnelliana, quæ sub hac specie enumerat celeberr. Baker, false determinata sunt; nonnulla ad *M. coccineam* S:t Hil. (vide supra!), alia ad *M. speciosam* (Ait. fil.) Hook. sunt referenda. Cujus speciei specimina adsunt

in Herb. Regnell. e Rio de Janeiro (Widgren, Riedel, Beyrich); Minas Geraes: Caldas (Regnell I: 199. Specimen unicum. — In palude. 18 $^{30}/_{10}$ 73. Mosén 612.); nec non e São Paulo: Santos (Loco uliginoso. 18 $^{25}/_{11}$ 74. Mosén 2890.).

Etiam in **Rio Grande do Sul** occurrit *M. speciosa* secundum specimina ab artificiosissimo horologiario E. Jeanneret Octobr. 1892 ad Dois Irmãos (Hamburgerberg) collecta, nobiscum communicata.

Ligulæ roseæ (Mosén).

Trichocline Cass.

T. foliosa Hook. & Arn. — Baker, l. c. pag. 371.

Rio Grande do Sul: pluribi at semper parce in Campos da Cima da Serra; specimina reportavimus e vicinitate oppidi Cruz Alta (18 $^{22}/_{4}$ 93, quo tempore jam pro parte maxima defloruerat. Malme 798.).

Ligulæ (aurantiacæ v.) subminuatæ v. fere rubræ.

T. macrocephala Less. — Baker, l. c. pag. 371.

Rio Grande do Sul: Piratiny pr. oppidum Pelotas (In campo sicco, arenoso, breviter graminoso. 18 $^{18}/_{12}$ 92. Malme 470.).

Ligulæ aurantiacæ.

T. incana (Lam.) Cass. — Baker, l. c. pag. 371.

Rio Grande do Sul: Cruz Alta Apr. 1893 e diario nostro, at specimina non reportavimus, quare determinatio non omnino certa.

Hæ species hibernant rosula foliorum, rhizomate brevi adscendente v. subverticali, radice crassa; scapi semper sunt axillares (nec terminales).

Chaptalia Vent.

Huic generi nomen *Thyrsanthema* Neck. forsan sit restituendum.

Ch. nutans (L.) Hemsl. — Baker, l. c. pag. 377.

Rio Grande do Sul: pluribi locis umbrosis, in fruticetis et »capões»; specimina reportata e Porto Alegre (18 $^{29}/_{9}$ 92. Malme 112. — Lindman 421.).

Ch. integrifolia (Cass.) Baker. — Baker, l. c. pag. 377.

Rio Grande do Sul: pluribi at fere semper parce, locis arenosis v. argillaceo-arenosis, apricis, sæpe terra ± nuda; specimina reportavimus ex Hamburgerberg (18 $^{25}/_{10}$ 92. Malme s. n.), Cachoeira (18 $^{24}/_{2}$ 93. Malme 660 B.).

Ch. piloselloides (Vahl) Baker. — Baker, l. c. pag. 378.

Rio Grande do Sul: Cachoeira (In campo aprico, breviter graminoso. 18 $^{10}/_{5}$ 93. Malme 812. Jam pro parte deflorata.).

Ch. exscapa (PERS.) BAKER. — BAKER, l. c. pag. 379.

Rio Grande do Sul: Cachoeira (In campo aprico, breviter graminoso. 18 $^{11}/_{5}$ 93. MALME 812 B.).

Chaptaliæ hic commemoratæ hibernant ut *Trichocline*.

Trixis P. BROWNE.

T. mollissima D. DON. — BAKER, l. c. pag. 383.

Rio Grande do Sul: Porto Alegre (In dumetis et pascuis, nec non in ruderibus. 18 $^{17}/_{9}$ 92. MALME 30.).

Frutex (v. suffrutex) usque ad 2 m. altus.

In vicinitate oppidi Caldas mensibus Jun. et Jul. floret.

T. divaricata (H. B. K.) SPRENG. — BAKER, l. c. pag. 384. — *T. antimenorrhoea* (SCHRANK) MART.

Matto Grosso: Buriti par. Santa Anna da Chapada (In »capoeira». 18 $^{27}/_{6}$ 94. MALME 1750 C. — Flores nondum bene evoluti.); **Paraguay**: Asuncion (Inter frutices; locis sat siccis. 18 $^{14}/_{7}$ 93. MALME 834.).

Var. **cladoptera** BAKER. — BAKER, l. c. pag. 385.

Argentina: Diamante civit. Entrerios (1895. KULLBERG).

T. verbasciformis LESS. — BAKER, l. c. pag. 387 (saltem p. p. maj.).

Paraguay: Asuncion, Villa Morra (18 $^{19}/_{1}$ 94. ANISITS 342.).

Huc pertinent REGNELL I: 223, WIDGREN 240, MOSÉN 1982; omnia in vicinitate oppidi Caldas collecta.

Var. **intermedia** MALME n. var.

Differt a forma genuina caule minus dense tomentoso, foliis et supra et subtus viridibus, subconcoloribus, supra pilis ± adpressis, basi incrassatis, sat parcis scabridulis v. hirtis, subtus parce tomentosis v. pubescentibus.

Minas Geraes: Caldas (WIDGREN s. n., REGNELL III: 173).

Forsan sit *Tr. megapotamica* HOOK. & ARN.

Var. **glaberrima** (LESS.) MALME. — BAKER, l. c. pag. 386 (*Tr. glaberrima* LESS.) e descriptione, at specimina haud pauca huc relata ad aliam pertinent speciem.

Differt a forma genuina caule (æque ac in forma genuina late alato) inferne glabro, foliis supra et subtus viridibus, supra pilis ± adpressis, basi incrassatis, sat parcis hirtulis, subtus glabris v. ad nervos parcissime pilosis, distinctius denticulatis.

Rio Grande do Sul: Cachoeira (In campo aprico, arenoso, inter Myrtaceas fruticosas, quas »Araça do Campo» dicunt incolæ. 18 $^{17}/_{2}$ 93. MALME 594.).

E speciminibus in Herb. Regnelliano asservatis huc pertinent etiam Mosén 4226 (Minas Geraes: Serra de Caldas, locis siccis apricis. 18 $^{30}/_{1}$ 76.), Lund (São Paulo: in paludosis ad S. Carlos.).

Regnell III: 807 et Widgren 224, quæ ad *Tr. glaberrimam* Less. traxit celeberr. Baker, nec non Mosén 4227, omnia in viciniis oppidi Caldas collecta, caule multo altiore, usque ad 3 m. alto, anguste alato v. superne exalato, foliis supra glabris, caulinis paucioribus (internodiis circiter 10 cm. longis), squamis exterioribus involucri interiores superantibus etc. a *T. verbascif.* var. *glaberrima* recedunt; ad aliam speciem (novam) pertinent, quam alio loco amplius describemus.

T. Lessingii DC. — Baker, l. c. pag. 390.

Rio Grande do Sul: Cachoeira (In ripa rivuli; loco uliginoso, aperto. 18 $^{21}/_{2}$ 93. Malme 622 B.).

T. ochroleuca (Cass.) Hook. & Arn. — Baker, l. c. pag. 391.

Paraguay: Lambaré pr. Asuncion (Loco breviter graminoso, glareoso, aperto, sat sicco. 18 $^{24}/_{8}$ 93. Malme 888.).

Labium exterius floris jam primitus album; interius primum ochroleucum, dein pallescens.

T. brasiliensis (L.) DC. — Baker, l. c. pag. 392.

Rio Grande do Sul: Pedras Brancas pr. Porto Alegre (Loco arenoso, sat aprico, terra denudata. 18 $^{8}/_{10}$ 92. Malme 148.), Canôas pr. Porto Alegre (Loco subhumido, parce graminoso, secundum viam ferream. 18 $^{10}/_{11}$ 92. Malme 148 B.).

Jungia L. fil.

J. floribunda Less. — Baker, l. c. pag. 393. — *J. pubescens* (Lag.) OK.

Rio Grande do Sul: colonia Ijuhy (In »roça» vetusta; loco subhumido, sat graminoso. 18 $^{30}/_{3}$—$^{3}/_{4}$ 93. Malme 736.), Cruz Alta (In campo; loco paludoso, graminoso. 18 $^{13}/_{4}$ 93. Malme 736 *β*.).

Herba perennis usque ad 2 m. alta, radicibus incrassatis fusiformibus vel moniliformibus.

Pamphalea Lag.

P. Commersonii Cass. — Baker, l. c. pag. 359.

Ic.: tab. nostr. VII fig. 20.

Rio Grande do Sul: Porto Alegre (Inter frutices; locis breviter graminosis, sat siccis apertisque. 18 $^{11}/_{10}$ 92. Malme 158.).

Herba perennis caule basi subglobose tuberoso, radicibus incrassatis fusiformibus.

Exped. I^{mæ} Regnellian. Phanerogamæ:

Compositæ,

quas determinavit Gust. O. A:n Malme.

N:o 12 C. Aspilia foliacea (Spreng.) Baker.
» 16 Inulopsis scaposa (DC.) O. Hoffm.
» 18 Vernonia desertorum Mart.
» 20 Baccharis humilis Sch. Bip.
» 30 Trixis mollissima D. Don.
» 32 Aspilia setosa Griseb.
» 73 Chevreulia acuminata Less.
» 80 Spilanthes arnicoides DC.
» 86 (86 β) Vernonia brevifolia Less.
92 (92 B) Blainvillea biaristata DC.
» 112 Chaptalia nutans (L.) Hemsl.
» 120 B. Porophyllum linifolium (L.) DC.
» 148 (148 B) Trixis brasiliensis (L.) DC.
» 158 Pamphalea Commersonii Cass.
» 168 Senecio pinnatus Poir. var. leptolobus (DC.) Baker.
» 174 Senecio heterotrichius DC.
176 Grindelia puberula Hook. & Arn. f. angustifolia Malme.
180 Hysterionica pinifolia (Poir.) Baker.
» 192 Mutisia coccinea S:t Hil.
» 198 Baccharis Glaziovii Baker.
» 202 Mikania involucrata Hook. & Arn.
224 Baccharis leucopappa DC.
228 Hieracium Commersonii Monn.
236 Eupatorium bupleurifolium DC. var. asclepiadeum (DC.) Baker.
» 238 Stenachenium campestre Baker.
» 240 Vernonia flexuosa Sims.
» 244 B. Heterothalamus psiadioides Less.
246 Calea pinnatifida (R. Br.) Less.
» 262 Senecio brasiliensis (Spreng.) Less.
» 276 Acanthospermum xanthioides (H. B. K.) DC.
» 278 Enhydra anagallis Gardn.
292 Conyza chilensis Spreng.
» 294 Eclipta lanceolata DC. var. longifolia Baker.
» 298 Erechthites valerianæfolia (Wolf) DC.
» 308 Galinsoga parviflora Cav.

N:o 318 Senecio crassiflorus (Lam.) DC. var. tricuspis Baker.
» 318 B. » » f. maritima Malme.
» 320 Spilanthes leptophylla DC.
» 324 Eclipta elliptica DC.
354 Tagetes minima L.
356 Anthemis mixta L.
» 362 Noticastrum eriophorum Remy.
» 370 Hysterionica pinifolia (Poir.) Baker.
» 372 Porophyllum brevifolium (Hook. & Arn.).
» 394 Noticastrum calendulaceum (Griseb.) Malme.
» 410 Gnaphalium cheiranthifolium Lam.
» 421 Chaptalia nutans (L.) Hemsl.
» 434 Mikania scandens Willd. * periplocifolia (Hook. & Arn.).
» 440 Vernonia flexuosa Sims.
» 441 Soliva sessilis R. & P.
» 454 Mutisia campanulata Less.
» 464 Vernonia squarrosa Less.
» 470 Trichocline macrocephala Less.
» 482 Eupatorium macrocephalum Less.
» 498 Elephantopus angustifolius Sw.
» 512 » scaber L. var. tomentosus (L.) Sch. Bip.
» 512 B. Blainvillea biaristata DC.
» 518 Moquinia polymorpha (Less.) DC. var. obtusifolia (Less.) DC.
» 526 Eupatorium bracteatum Hook. & Arn.
» 528 » caaguazuense Hieron.
» 532 Baccharis anomala DC.
» 536 » genistelloides (Lam.) Pers. * trimera DC.
» 546 Vernonia glabrata Less.
» 548 V. nudiflora Less.
» 550 V. platensis (Spreng.) Less.
» 552 V. rubricaulis H. B. var. australis Hieron.
» 556 Conyza arguta Less.
» 562 Mikania cordifolia (L. fil.) Willd.
» 564 Eupatorium nummularia Hook. & Arn.

N:o 566 Gnaphalium Gaudichaudianum DC.
» 568 Eupatorium grande SCH. BIP.
» 570 Pterocaulon angustifolium DC.
» 570 B. Pluchea quitoc DC.
» 570 C. Stenachenium megapotamicum (SPRENG.) BAKER.
» 572 Eupatorium Candolleanum HOOK. & ARN.
» 572 C. Eupatorium betonicæforme (DC.) BAKER.
» 578 Pterocaulon Lorentzii MALME.
» 580 Eclipta alba (L.) HASSK.
» 584 Hieracium Commerssonii MONN.
» 586 Lucilia acutifolia (POIR.) CASS.
» 588 Eupatorium squarrulosum HOOK. & ARN.
» 594 Trixis verbasciformis LESS. var. glaberrima (LESS.) MALME.
» 604 Pterocaulon angustifolium DC.
» 606 Achyrocline satureoides (LAM.) DC.
» 608 Erigeron bonariensis L.
» 610 Solidago microglossa DC.
» 612 Eupatorium subhastatum HOOK. & ARN.
» 616 B. » Candolleanum HOOK. & ARN.
» 618 Hypochæris Gardneri BAKER.
» 620 Vernonia megapotamica SPRENG.
» 622 Calea uniflora LESS.
» 622 B. Trixis Lessingii DC.
» 628 Aster exilis ELL.
» 628 γ » » » var. graminifolius (SPRENG.).
» 636 Vernonia Sellowii LESS.
» 638 Baccharis subopposita DC. var. affinis (DC.) BAKER.
» 640 Conyza chilensis SPRENG.
» 646 Verbesina sordescens DC.
» 648 Moquinia mollissima MALME.
» 652 Noticastrum sp.
» 656 Baccharis tenuifolia DC.
» 660 Achyrocline alata (H. B. K.) DC.
» 660 B. Chaptalia integrifolia (CASS.) BAKER.
» 660 C. Conyza triplinervia LESS.
» 664 Porophyllum ruderale (JACQ.) CASS.
» 666 Baccharis dracunculifolia DC.
» 668 Eupatorium serratum SPRENG.
» 670 E. hecatanthum (DC.) BAKER.
» 672 Pluchea quitoc DC.
» 672 B. Stenachenium megapotamicum (SPRENG.) BAKER.
» 674 Podocoma hirsuta BAKER.
» 680 B. Eupatorium sp. (E. grande SCH. BIP.?)
» 702 Adenostemma viscosum FORST. var. triangulare (DC.) BAKER.
» 706 Conyza triplinervia LESS.
» 708 Eupatorium foliatum (SCH. BIP.) HIERON.
» 712 Baccharis punctulata DC.
» 718 Baccharis platensis SPRENG.
» 720 Eupatorium inulæfolium H. B. K.
» 722 Solidago microglossa DC.
» 724 Jægeria hirta (LAG.) LESS.
» 724 B. Eupatorium oblongifolium (SPRENG.) BAKER.
» 724 C. » multi-crenulatum SCH. BIP.
» 726 Mikania ternifolia DC.
» 726 B. Stevia laxa HOOK. & ARN. var. curtula MALME.

N:o 728 Asteropsis macrocephala LESS.
» 732 Mikania apiifolia DC.
» 734 » chlorolepis BAKER.
» 736 Jungia floribunda LESS.
» 738 Polymnia silphioides DC.
» 740 Pterocaulon interruptum DC.
» 740 B. Achyrocline satureoides (LAM.) DC.
» 744 Erechthites missionum MALME.
» 746 » hieraciifolia (L.) RAF.
» 750 » valerianæfolia (WOLF) DC.
» 752 Eupatorium picturatum MALME.
» 756 B. Conyza notobellidiastrum GRISEB.
» 760 Vernonia Tweedieana BAKER.
» 760 B. Jægeria hirta (LAG.) LESS.
» 762 Baccharis tenuifolia DC. var. leptophylla (DC.)
» 762 B. Vernonia megapotamica SPRENG.
» 764 Vernonia chamædrys LESS.
» 766 Eupatorium lævigatum LAM.
» 768 Achyrocline satureoides (LAM.) DC. var.
» 770 Eupatorium oblongifolium (SPRENG.) BAKER.
» 772 Baccharis pentodonta MALME.
» 774 Eupatorium lætevirens HOOK. & ARN.
» 776 Erechthites valerianæfolia (WOLF) DC. forma.
» 778 Leucopsis Tweediei (HOOK. & ARN.) BAKER.
» 780 Eupatorium Tweedieanum HOOK. & ARN.
» 780 B. Jægeria hirta (LAG.) LESS
» 782 Chuquiragua glabra (SPRENG.) BAKER.
» 786 Stevia cruziana MALME.
» 788 Tagetes minuta L.
» 790 Senecio icoglossus DC.
» 792 Hysterionica montevidensis (SPRENG.) BAKER.
» 792 B. Eupatorium multicrenulatum SCH. BIP.
» 792 C. Vernonia Tweedieana BAKER.
» 794 Viguiera pilosa BAKER.
794 B. Wedelia stenophylla (HOOK. & ARN.) GRISEB.
» 794 C. Verbesina sordescens DC.
» 796 Eupatorium tremulum HOOK. & ARN.
» 798 Trichocline foliosa HOOK. & ARN.
» 800 Aster calocephalus MALME.
» 800 B. Hypochæris Gardneri BAKER.
802 Baccharis megapotamica SPRENG.
» 802 B. Eupatorium vernoniopsis SCH. BIP. var. roseoviolaceum MALME.
» 802 C. Aster setosus BAKER.
» 804 Stevia satureifolia (LAM.) SCH. BIP. var. multiaristata (SPRENG.) BAKER.
» 806 B. Eupatorium Tweedieanum HOOK. & ARN.
» 806 C. Baccharis dracunculifolia DC.
» 808 Baccharis coridifolia DC.
» 810 Senecio pinnatus POIR. var. leptolobus (DC.) BAKER.
» 812 Chaptalia piloselloides (VAHL) BAKER.
» 812 B. » exscapa (PERS.) BAKER.
» 812 C. Lucilia nitens LESS.
814 B. Podocoma hieraciifolia (POIR.) CASS.
» 816 B. Sommerfeltia spinulosa (SPRENG.) LESS.
» 820 Hysterionica pinifolia (POIR.) BAKER.

N:o 820 B. Baccharis artemisioides HOOK. & ARN.
» 822 Eupatorium ligulæfolium HOOK. & ARN.
» 824 Baccharis rotundifolia SPRENG.
» 826 B. Heterothalamus psiadioides LESS.
» 826 D. Baccharis articulata (LAM.) PERS.
» 826 F. Gnaphalium purpureum L. * spicatum LAM.
» 826 G. Erechthites hieraciifolia (L.) RAFIN.
» 826 I. Lactuca virosa L.
» 830 Acanthospermum hispidum DC.
» 832 (832 β & γ) Calea clematidea BAKER.
» 832 B. (832 C.) Vernonia scorpioides PERS.
» 834 Trixis divaricata (H. B. K.) SPRENG.
» 844 Senecio Balansæ BAKER.
» 846 Vernonia scabra PERS.
» 852 Baccharis varians GARDN.
» 864 Eupatorium megaphyllum BAKER.
» 870 Chuquiragua glabra (SPRENG.) BAKER.
» 872 Eupatorium macrophyllum SW.
» 880 Senecio Benthami GRISEB.
» 882 Mikania laxa DC. * euryanthela MALME.
» 888 Trixis ochroleuca HOOK. & ARN.
» 898 B. Mikania scandens WILLD. * periplocifolia HOOK. & ARN.
» 904 Aspilia silphioides (HOOK. & ARN.).
» 906 Tessaria integrifolia R. & P.
» 910 Senecio Balansæ BAKER.
» 912 Soliva anthemidifolia (JUSS.) R. BR.
» 930 Echinocephalum latifolium GARDN.
» 932 Wedelia brachycarpa BAKER.
» 946 Mikania scandens (L.) * paraguayensis MALME.
» 952 Vernonia nitidula LESS.
» 964 Aspilia latissima MALME.
» 1012 Gnaphalium purpureum L. forma.
» 1014 Pterocaulon purpurascens MALME.
» 1014 B. » subvirgatum MALME.
» 1082 C. Aspilia setosa GRISEB.
» 1090 E. Mikania scandens (L.) * periplocifolia HOOK. & ARN. var. intermedia MALME.
» 1040 D. Conyza chilensis SPRENG.
1122 C. Vernonia obovata LESS.
» 1158 Isostigma peucedanifolium (SPRENG.) LESS.
» 1160 Aspilia leucoglossa MALME.
» 1190 Riencourtia tenuifolia GARDN. var. intermedia MALME.
» 1236 (1236*) Oyedæa ovata (GARDN.) BAKER.
» 1266 Melampodium hispidum DC.
» 1266 B. Eupatorium kleinioides H. B. K.
» 1278 (1278 β et γ) Wulffia stenoglossa (CASS.) DC. var.
» 1278 C. Wedelia macrodonta DC.
» 1286 B. Baccharis subcapitata GARDN.
» 1304 Riencourtia oblongifolia GARDN.
» 1366 B. Vernonia remotiflora RICH.
» 1368 B. Porophyllum macrolepideum MALME.
» 1394 B. Pectis stella MALME.
» 1404 Ichthyothere Cunabi MART.
» 1408 Eupatorium macrophyllum L.
» 1410 B. Bidens pilosus L.

N:o 1410 C. Zinnia multiflora L.
» 1416 Calea ferruginea SCH. BIP.
» 1416 B. Piptocarpha rotundifolia (LESS.) BAKER.
» 1440 B. Mikania officinalis MART.
1460 Vernonia bardanoides LESS.
» 1460 B. » buddleiæfolia MART.
» 1462 » rigescens. MALME.
» 1462 B. » obtusata LESS.
» 1470 B. Calea sp.
» 1488 B. Eupatorium squalidum DC.
» 1490 Stilpnopappus speciosus (LESS.) BAKER.
» 1498 Vernonia remotiflora RICH.
» 1510 Kanimia palustris GARDN.
» 1516 Vernonia onopordioides BAKER.
» 1516 B. » onopordioides BAKER.
» 1518 » lævigata MART.
» 1518 B. (1518 Bβ) Vernonia remotiflora RICH.
» 1520 Vernonia obtusata LESS.
» 1526 Calea lantanoides GARDN.
» 1526 B. Pectis stella MALME.
» 1528 Eupatorium lupulinum BAKER.
» 1542 » lævigatum LAM.
» 1560 » kleinioides H. B. K.
» 1566 » squalidum DC. var. tomentosum (SCH. BIP.) BAKER.
» 1584 Isostigma foliosum MALME.
» 1598 Eupatorium asperrimum SCH. BIP.
» 1598 B. » conyzoides VAHL. var. Maximiliani (DC.) BAKER.
» 1598 C. Eupatorium pictum GARDN.
» 1598 C.* » myriocephalum GARDN.
» 1606 Vernonia membranacea GARDN.
» 1608 Mikania psilostachya DC. var. scabra (DC.) BAKER.
» 1614 Eupatorium subtruncatum GARDN.
» 1616 Eremanthus glomerulatus LESS.
» 1618 Vernonia echitifolia MART.
» 1620 Aster Regnellii (SCH. BIP.) BAKER. * mattogrossensis MALME.
» 1632 Elephantopus riparius GARDN.
» 1644 Vernonia chamæpeuces SCH. BIP.
» 1646 Chuquiragua mattogrossensis MALME.
» 1648 Barnadesia rosea LINDL.
» 1656 Vernonia declivium MALME.
» 1658 Viguiera robusta GARDN.
» 1658 B. Porophyllum angustissimum GARDN.
» 1678 Alomia Regnellii MALME.
» 1682 Cosmos caudatus H. B. K.
» 1682 C. Achyrocline satureoides (LAM.) DC. var.
» 1700 Vernonia oreophila MALME.
» 1708 Eremanthus exsuccus (DC.) BAKER.
» 1744 Eupatorium glandulosissimum MALME.
» 1744 B. Vernonia araneosa BAKER.
» 1750 Baccharis trinervis (LAM.) PERS.
» 1750 B. Chuquiragua sp.
» 1750 C. Trixis divaricata (H. B. K.) SPRENG.
» 1756 Eupatorium oxychlænum DC.
» 1756 B. Eupatorium dentatum GARDN.
» 1760 B. Vernonia ferruginea LESS.
» 1768 Gymnocoronis spilanthoides (D. DON) DC.

N:o 1770 Chuquiragua glabra (SPRENG.) BAKER.
» 1800 Centratherum punctatum CASS.
» 1802 Blainvillea rhomboidea CASS.
» 2151 Mikania scandens (L.) WILLD. * periplocifolia HOOK. & ARN.
» 2305 Spilanthes macropoda DC.
» 3023 Pectis jangadensis SPENC. MOORE.
s. n. (18 25/10 92) Chaptalia integrifolia (CASS.) BAKER.
» (18 11/5 93) Baccharis genistelloides (LAM.) PERS. * trimera DC.
» (18 21/12 93) Eupatorium kleinioides H. B. K. forma.
s. n. (18 17/2 94) Mikania officinalis MART.
» (18 27/3 94) Vernonia obscura LESS.
» (18 1/4 94) Isostigma foliosum MALME.
(18 13/4 94) Eupatorium squalidum DC.
» (18 16/4 94) Vernonia rubricaulis H. B. K.
» (18 27/4 94) Eupatorium squalidum DC. var. Martiusii (DC.) BAKER.
» (18 3/5 94) Pectis jangadensis SPENC. MOORE.
» (18 7/5 94) Eupatorium squalidum DC.
» (18 22/6 94) Vernonia pulverulenta BAKER.

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Corrigenda:

Pag. 16, lin. 14. Blättern versehen. *lege:* Blättern versehen
» *18*, » *3.* Inflorescenz beblättert *lege:* Inflorescenz beblättert;
» *23*, » *infima.* examinavinus *lege:* examinavimus
» *40*, » *10.* obtusa basi, longe cuneata *lege:* obtusa, basi longe cuneata
» *54*, » *28.* 909 *lege:* 906
» *55*, » *32.* occurit *lege:* occurrit

Explicatio tabulæ.

Tab. I.

Vernonia megapotamica Spreng. **eriocephala* Malme.

Fig. 1 cal. Calathidium. $^{3}/_{1}$.
» 1 sq. Squama superior involucri a dorso visa. $^{5}/_{1}$.

Vernonia declivium Malme.

Fig. 2 h.[1] Ramus. $^{1}/_{1}$.
» 2 sq. Squamæ involucri (infima, media superior, summa s. intima) a dorso visæ. $^{5}/_{1}$.

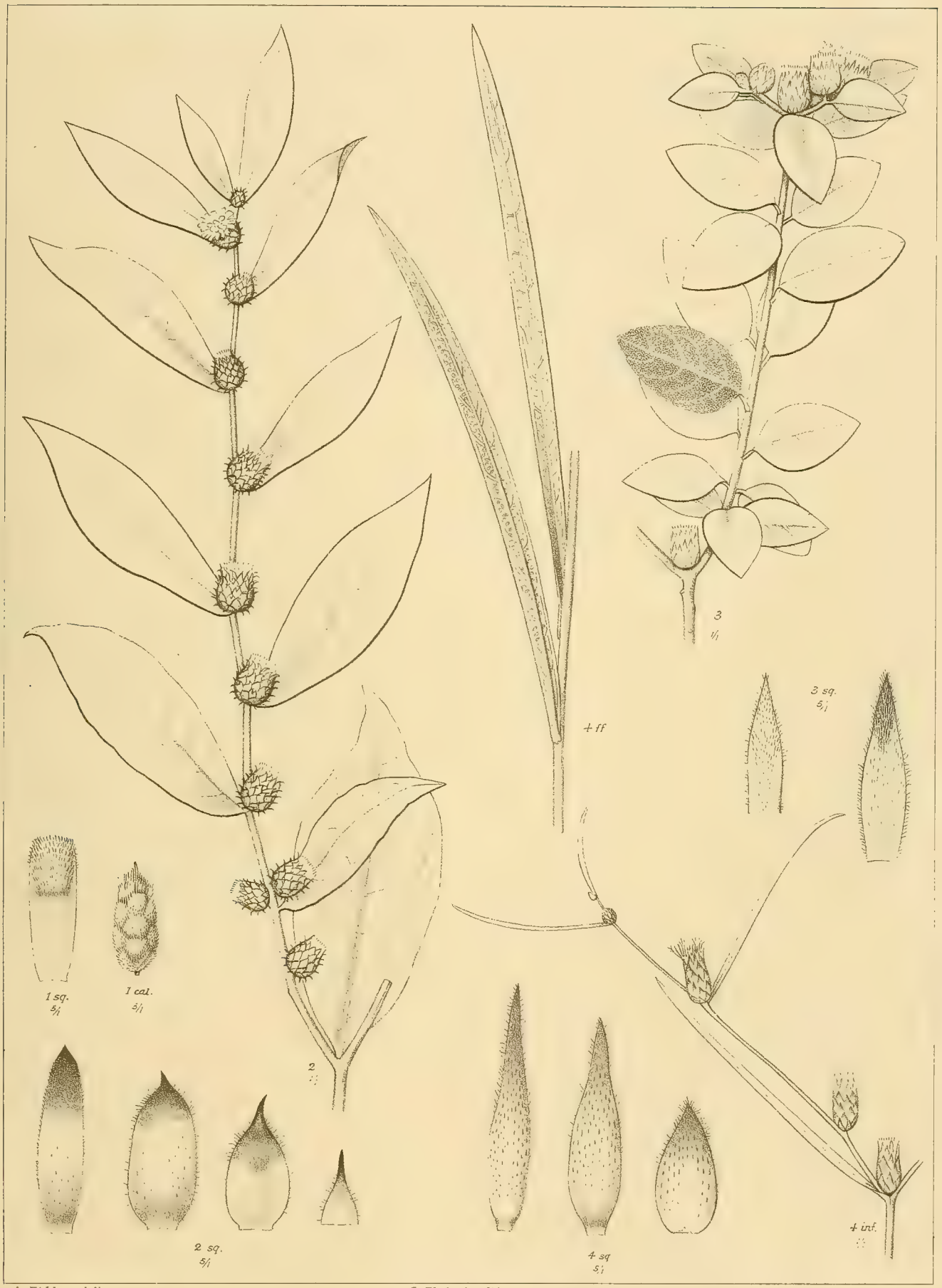
Vernonia oreophila Malme.

Fig. 3 h.[1] Ramus. $^{1}/_{1}$.
» 3 sq. Squamæ involucri (inferior, superior) a dorso visæ. $^{5}/_{1}$.

Vernonia rigescens Malme.

Fig. 4 ff. Folia caulina, nodi, internodium. $^{1}/_{1}$.
» 4 inf. Pars inflorescentiæ. $^{1}/_{1}$.
» 4 sq. Squamæ involucri (media, superior, summa s. intima) a dorso visæ. $^{5}/_{1}$.

[1] Siglum »h» in tabula est omissum.



A. Ekblom delin. G. Tholander lith. W. Schlachter Stockholm.

1) Vernonia *eriocephala MALME. 2) V. declivium. MALME.
3) V. oreophila MALME. 4) V. rigescens MALME.

Explicatio tabulæ.

Tab. II.

Vernonia declivium Malme.

Fig. 2 f. Folium caulinum a dorso visum. $^{1}/_{1}$.

Alomia Regnellii Malme.

Fig. 5 h.[1] Pars major superior herbæ totius. $^{1}/_{1}$.
» 5 inv. Involucrum. $^{3}/_{1}$.
» 5 sq. Squamæ involucri (inferior, superior) a dorso visæ. $^{10}/_{1}$.
» 5 fl. Flos. $^{10}/_{1}$.
» 5 ach. Achenium. $^{10}/_{1}$.

Stevia cruziana Malme.

Fig. 6 nf. Folium caulinum, nodus. $^{1}/_{1}$.
» 6 inf. Pars inflorescentiæ. $^{1}/_{1}$.
» 6 cal. Calathidium. $^{5}/_{1}$.

[1] Sigulum »h» in tabula est omissum.

A. Ekblom delin. G. Tholander lith. W. Schlachter, Stockholm.

2) Vernonia declivium MALME. 5) Alomia Regnellii MALME. 6) Stevia cruziana MALME.

Explicatio tabulæ.

Tab. III.

Mikania scandens (L.) Willd. **periplocifolia* Hook. & Arn.

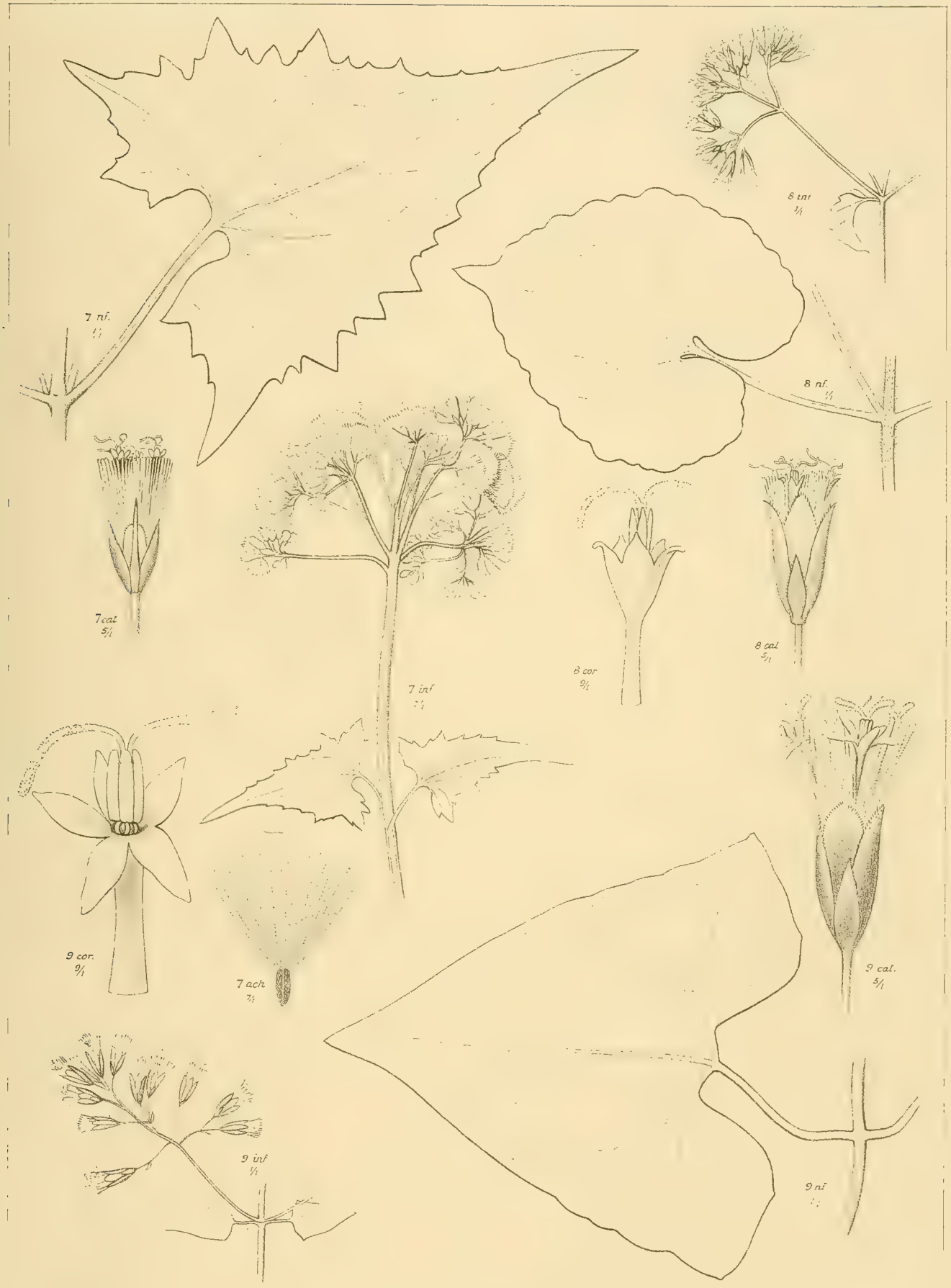
Fig. 7 nf. Nodus, folium. 1/1.
» 7 inf. Inflorescentia. 1/1.
» 7 cal. Calathidium. 5/1.
» 7 ach. Achenium. 7/1.

Mikania scandens (L.) Willd. **opifera* Mart.

Fig. 8 nf. Nodus, folium. 1/1.
» 8 inf. Pars inflorescentiæ. 1/1.
» 8 cal. Calathidium. 5/1.
» 8 cor. Corolla. 9/1.

Mikania laxa DC. **euryanthela* Malme.

Fig. 9 nf. Nodus, folium. 1/1.
» 9 inf. Pars inflorescentiæ. 1/1.
» 9 cal. Calathidium. 5/1.
» 9 cor. Corolla. 9/1.



A. Eklöm. delin. G. Thelander lith. W. Schlachter, Stockholm.

7) Mikania scandens (L.) *periplocifolia HOOK & ARN. 8.) M *opifera MART,
9) M. laxa DC.*euryanthela MALME.

Explicatio tabulæ.

Tab. IV.

Micania scandens (L.) Willd. **paraguayensis* Malme.

Fig. 10 nf. Nodus, folium. $^{1}/_{1}$.
» 10 cal. Calathidium. $^{5}/_{1}$.

Eupatorium picturatum Malme.

Fig. 11 nf. Nodus, folium. $^{1}/_{1}$.
» 11 cal. Calathidium. $^{3}/_{1}$.
» 11 fl. Flos. $^{5}/_{1}$.

Baccharis pentodonta Malme.

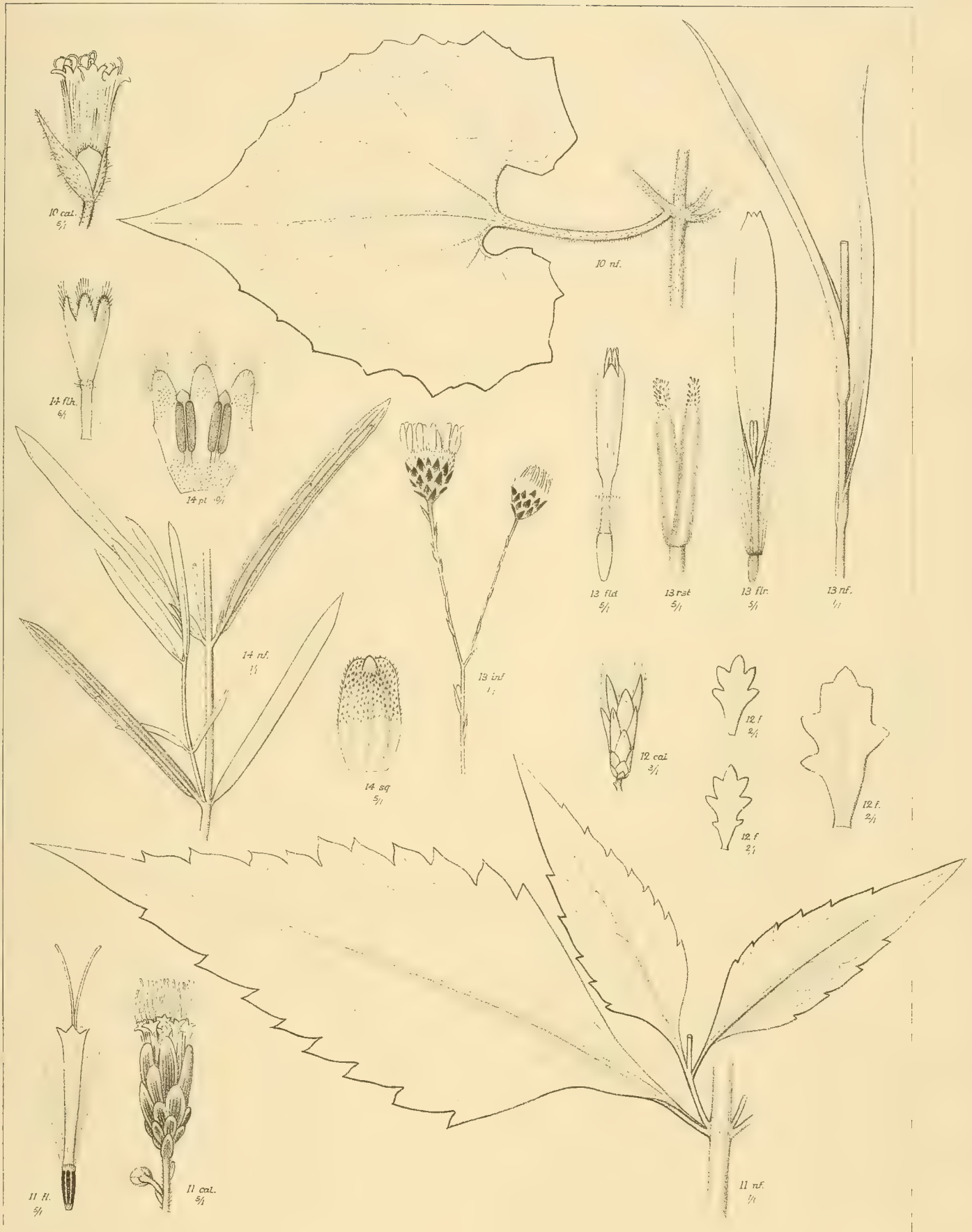
Fig. 12 f. Folia. $^{2}/_{1}$.
» 12 cal. Calathidium. $^{3}/_{1}$.

Aster calocephalus Malme.

Fig. 13 nf. Nodi, folia. $^{1}/_{1}$.
» 13 inf. Pars inflorescentiæ. $^{1}/_{1}$.
» 13 flr. Flos radii. $^{5}/_{1}$.
» 13 fld. Flos disci (pappo truncato). $^{5}/_{1}$.
» 13 rst. Rami styli floris radii abnormaliter appendiculati. Valde aucti.

Riencourtia tenuifolia Gardn. var. *intermedia* Malme.

Fig. 14 nf. Pars caulis cum foliis. $^{1}/_{1}$.
» 14 sq. Squama involucri a dorso visa. $^{5}/_{1}$.
» 14 flh. Flos hermaphroditicus. $^{6}/_{1}$.
» 14 pl. Pars limbi floris hermaphroditici aperti explanata. $^{10}/_{1}$.



A. Ekblom delin. G Tholander lith. W. Schlachter. Stockholm.

10.) Mikania *paraguavensis MALME. 11.) Eupatorium picturarum MALME. 12.) Baccharis pentodonta MALME. 13.) Aster calocephalus MALME. 14.) Riencourtia tenuifolia GARDN. var. intermedia MALME.

Explicatio tabulæ.

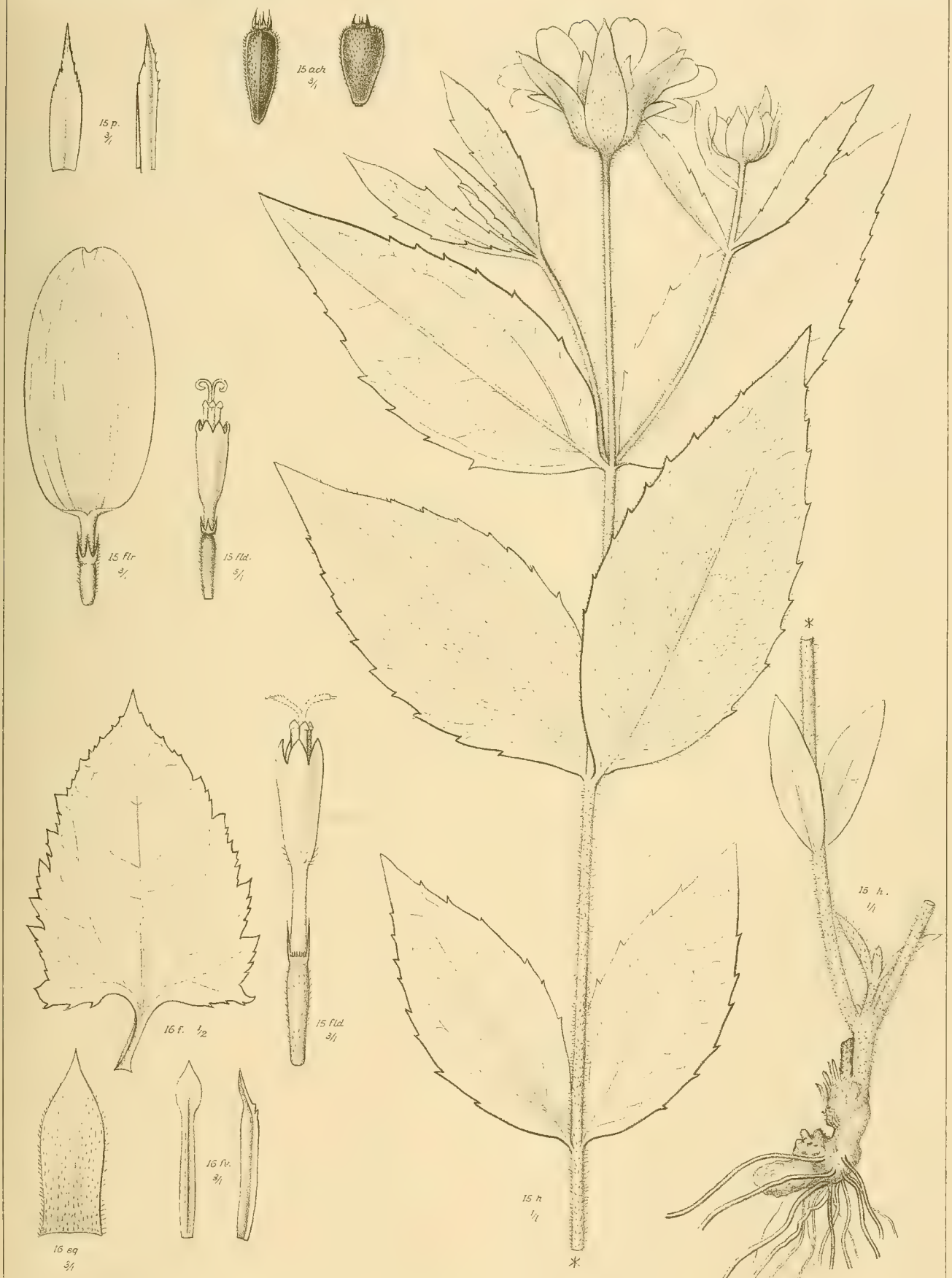
Tab. V.

Aspilia leucoglossa Malme.

Fig. 15 h. Herba tota. $^{1}/_{1}$.
» 15 flr. Flos radii. $^{3}/_{1}$.
» 15 fld. Flos disci. $^{3}/_{1}$.
» 15 p. Palea receptaculi a dorso et a latere visa. $^{3}/_{1}$.
» 15 ach. Achenia. $^{3}/_{1}$.

Asqilia latissima Malme.

Fig. 16 f. Folium. $^{1}/_{2}$.
» 16 sq. Squama involucri. $^{3}/_{1}$.
» 16 p. Palea receptaculi a dorso et a latere visa. $^{3}/_{1}$.
» 16 fld. Flos disci. $^{3}/_{1}$.



A. Ekblom delin. G Tholander lith. W. Schlachter, Stockholm

15) Aspilia leucoglossa MALME. 16) Aspilia latissima MALME.

Explicatio tabulæ.

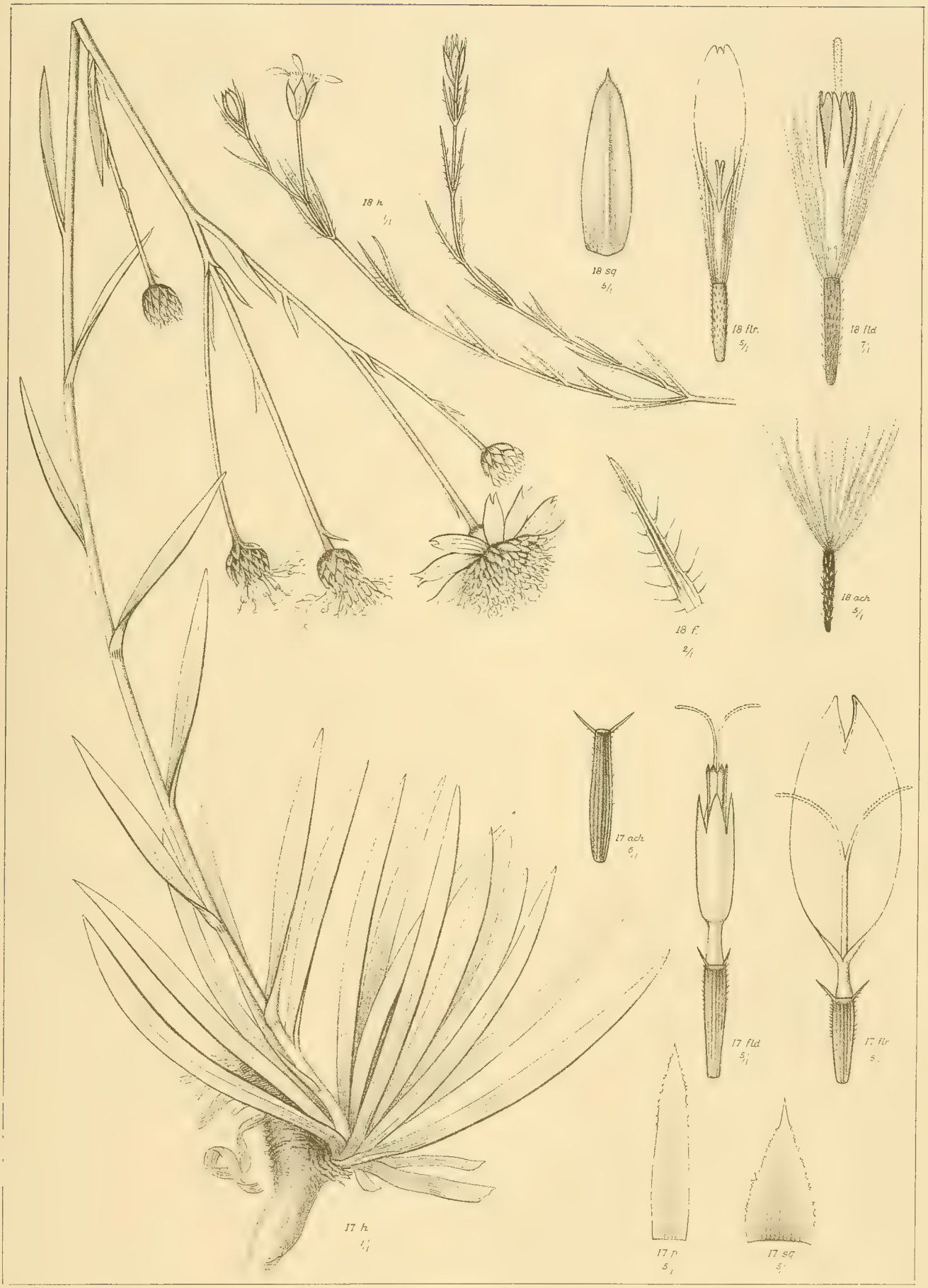
Tab. VI.

Isostigma foliosum Malme.

Fig. 17 h. Herba tota. $^{1}/_{1}$.
» 17 sq. Squamæ involucri. $^{5}/_{1}$.
» 17 p. Palea receptaculi. $^{5}/_{1}$.
» 17 flr. Flos radii. $^{5}/_{1}$.
» 17 fld. Flos disci. $^{5}/_{1}$.
» 17 ach. Achenium. $^{5}/_{1}$.

Pectis stella Malme.

Fig. 18 h. Ramus. $^{1}/_{1}$.
» 18 f. Folium. $^{2}/_{1}$.
» 18 sq. Squamæ involucri. $^{5}/_{1}$.
» 18 flr. Flos radii. $^{5}/_{1}$.
» 18 fld. Flos disci. $^{7}/_{1}$.
» 18 ach. Achenium. $^{5}/_{1}$.



A. Ekblom delin. G. Tholander lith. W. Schlachter Stockholm

Isostigma foliosum MALME. 18) Pectis stella MALME.

Explicatio tabulæ.

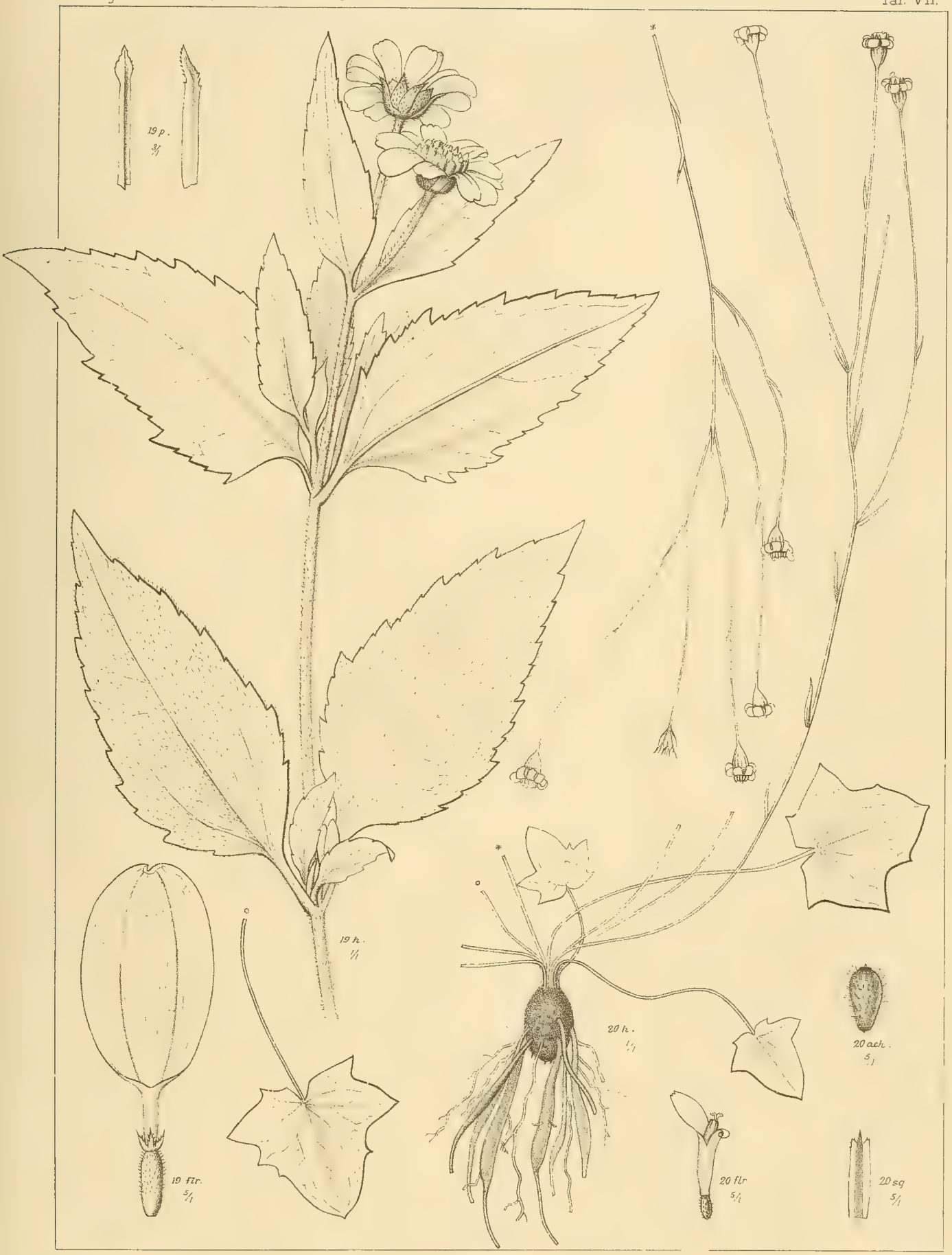
Tab. VII.

Aspilia silphioides (Hook. & Arn.) Benth.

Fig. 19 h. Ramus. $^{1}/_{1}$.
» 19 flr. Flos radii. $^{5}/_{1}$.
» 19 p. Palea receptaculi a dorso et a latere visa. $^{3}/_{1}$.

Pamphalea Commersonii Cass.

Fig. 20 h. Herba tota. $^{1}/_{1}$.
» 20 sq. Squamæ involucri. $^{5}/_{1}$.
» 20 flr. Flos radii. $^{5}/_{1}$.
» 20 ach. Achenium. $^{5}/_{1}$.



A. Ekblom delin. G. Tholander lith W. Schlachter, Stockholm.

19) Aspilia silphioides (HOOK. & ARN.). 20) Pamphalea Commersonii CASS.

KONGL. SVENSKA VETENSKAPS-AKADEMIENS HANDLINGAR. Bandet 32. N:o 6.

ANIMALISCHES PLANKTON

AUS DEM MEERE ZWISCHEN

JAN MAYEN, SPITZBERGEN, K. KARLS LAND

UND

DER NORDKUSTE NORWEGENS.

VON

CARL W. S. AURIVILLIUS.

DER K. SCHWEDISCHEN AKADEMIE DER WISSENSCHAFTEN VORGELEGT AM 7. JUNI 1899.

GEPRÜFT VON O. PETTERSSON UND HJ. THÉEL.

STOCKHOLM
KUNGL. BOKTRYCKERIET. P. A. NORSTEDT & SÖNER
1899

Die unten in den Tabellen verzeichneten Planktonfänge sind während vier schwedischer Expeditionen nach Spitzbergen und zwar 1) der Virgo-Expedition 1896, 2) der De Geer'-schen Expedition 1896, 3) der Svensksund-Expedition 1897 und 4) der Antarctic Expedition 1898 gemacht.

Es sind dabei verschiedene Fangmethoden in Anwendung gebracht, nämlich während 1) theils das Fangen von dem gehenden Dampfer aus mittelst eines Netzes mit konischem Aufsatze, theils — in den Häfen — mit dem gewöhnlichen Schleppnetz; während 2) nur mit dem letztgenannten; während 3) die Pumpenmethode und 4) in der Oberfläche das gewöhnliche Schleppnetz, in der Tiefe ein nicht schliessbares Vertikalnetz und über dem Boden ein schliessbares Schleppnetz.

In den meisten Fällen sind, mit den Planktonfängen gleichzeitig, auch Wasserproben genommen, welche, auf die Temperatur und den Salzgehalt untersucht, eine Vergleichung zwischen den Beziehungen der planktonischen Organismen zu den physikalischen Bedingungen gestatten.

Dass die Antarctic-Expedition die bei weitem grösste Fülle von Beobachtungen in beiden Richtungen geleistet hat, kann theils dem Umstande zugeschrieben werden, dass sie für Planktonfang ganz besonders reich ausgerüstet gewesen und zwar denselben unter den Hauptzwecken der Expedition gestellt hatte, theils auch dass es ihr gelang eine sehr bedeutende Anzahl von einander weit entfernter Punkte nicht nur ringsum Spitzbergen, sondern auch von $\frac{3^\circ\ 5'\ \text{W. Long.}}{77^\circ\ 52'\ \text{N. Lat.}}$ ab bis nach $\frac{34^\circ\ 30'\ \text{O. Long.}}{78^\circ\ 38'\ \text{N. Lat.}}$ zu untersuchen. Dazu kommt, dass die Kenntniss des Planktons der Tiefsee durch diese Expedition ganz vorzüglich erweitert worden ist, indem früher nur vereinzelte Thatsachen über diese Fauna, und zwar durch die norwegische Nordhavs-Expedition — siehe unten — bekannt waren.

Wenn auch künftige Forschungen ohne Zweifel viel neues zu den Resultaten dieser schwedischen Expeditionen hinfügen und besonders über die vertikale Verbreitung der Planktonorganismen ein helleres Licht werfen werden, so kann jedenfalls das vorliegende Material, auch deshalb dass es aus 3 verschiedenen Jahren stammt, ein vollständigeres Bild als das wir früher hatten, von dem Planktonleben dieser Gegenden geben.

I.

Frühere Angaben über die Planktonorganismen des Meeres zwischen Jan Mayen—Spitzbergen und dem nördlichen Norwegen.

Es liegen in der Litteratur verhältnissmässig spärliche Angaben über das animalische Plankton des fraglichen Meeresabschnittes vor.

In seiner »Spitzbergischen oder Grönländischen Reisebeschreibung 1671, Hamburg 1675» giebt Fr. Martens im 12. Capitel, das »von Rotzfischen und Seekwalm» handelt, drei Thiere, nämlich 1. See-Gott Pferd, 2. Schnecken-Rotzfisch, beide in Südbay in Spitzbergen am 20. Juni gefunden, und 3. Mützner Rotzfisch, in Muschelhafen daselbst am 8. Juli gefangen, an, welche ohne Zweifel dem Plankton zugerechnet werden können.

Es werden später deren zwei von Phipps, »Voyage au pole boréal 1773, Paris 1775», als resp.

1) Clio helicina = *Limacina helicina* Phipps und

2) Clio limacina = *Clione limacina* Phipps erkannt.

Dieselben sind auch von W. Scoresby, »An account of the arctic regions, Edinburgh 1820» erwähnt: dagegen können die von ihm abgebildeten Medusen (Pl. XVI, Fig. 3—8) nicht sicher identificirt werden.

Zwei Jahre später hat M. G. Mandt, »Observationes in historiam naturalem et anatomiam comparatam in itinere grönlandico factæ», unweit Jan Mayen theils frei, theils im Magen von »Procellaria glacialis» Exemplare von

Gammarus libellula = *Euthemisto libellula* Mandt angetroffen.

Ferner wird von M. Sars, »Oversigt over de i den norsk-arktiske Region forekommende Krebsdyr, Christiania 1858»

Calanus hyperboreus Kröyer

erwähnt, und zwar mit der Bemerkung, er finde sich an »hele Finmarkens Kyst, ofte i utrolig Mængde. Den går sydlig i det mindste til Bergen og nordlig til Spitzbergen og Grönland. Es ist also unter diesem Namen sowohl

Calanus finmarchicus Gunn. als

» *hyperboreus* Kr.

einbegriffen.

In Öfvers. K. Vet.-Akad. Förh. 1875 hat W. Liljeborg in einer Abhandlung: »De under svenska vetenskapliga expeditionen till Spetsbergen 1872—1873 derstädes samlade hafs-entomostraceer» folgende Meeresplanktonthiere erwähnt:

1) *Calanus finmarchicus* Gunn.; mit der Bemerkung:

»Större ex. af — 8 mm. öfverensstämma uti storleken med den form, som Kröyer kallat *Calanus hyperboreus*.

2) Metridia armata Boeck = *M. longa* Lubbock (fide Giesbr.).

»Mosselbay Dec. 1872 och Jan. 1873, dels i hafsytan, dels i genomdränkt snö på stranden och dels i mera torr snö i närheten af stranden.»

3) Oithona spinirostris Claus,

4) » pygmæa Boeck, beide von Giesbrecht mit *O. similis* Claus, jedoch unter ?, identificirt.

E. J. Miers, in Ann. and Mag. Nat. Hist. 4 ser. XIX, 1877, giebt eine »List of the species of Crustacea collected by the Rev. A. Eaton at Spitzbergen in the summer of 1873» und zwar wird darunter auch

Themisto libellula Mandt in folgender Weise erwähnt:

»Spitzbergen. Abundant among the floes and along the shore. Some of the specimens were found in a Saddlebock's stomach killed off the western Ice in green water.»

Unter den »Jan Mayen Mollusca from the Norwegian North Atlantic Expedition in 1877» hat H. Friele verzeichnet:

1) *Limacina helicina* Phipps,

2) *Clione limacina* Phipps.

In seinem »System der Medusen, Jena 1879—80» hat Hæckel aus dem fraglichen Meere folgende Formen besonders erwähnt, nämlich:

1) *Stenoptycha dactylometra* Hæck. Beeren Island.

2) *Cyanea arctica* Pér. et Les. Spitzbergen (Schmidt).

3) *Staurostoma arctica* Hæck. » »

J. Sparre-Schneider, in »Undersögelser af dyrelivet i de arktiske fjorde. II. Crustacea og Pycnogonida indsamlede i Kvænangsfjorden 1881. Tromsö 1884», hat folgende Planktonthiere verzeichnet:

1) *Euphausia inermis* Kr.

2) *Themisto libellula* Mandt.

3) *Parathemisto oblivia* Kr.

4) *Calanus finmarchicus* Gunn.

Unter den planktonischen Krebsthieren, welche von G. O. Sars, »Den norske Nordhavs-Expedition 1876—78, Zool. Crustacea. Christiania 1885», erwähnt sind, beziehen sich die Fundorte folgender ansdrücklich auf das fragliche Meeresgebiet:

1) *Boreophausia inermis* Kr. »Jan Mayen. Spetsb.»

2) *Thysanoëssa tenera* G. O. Sars. »Varangerfjord. Paa 4 forskjellige stationer i det aabne Hav mellem Norge och Jan Mayen. (Alle in der Oberfläche.)

3) *Themisto libellula* Mandt.

Der südlichste Fundort war Lat. 66° N. »*Her og paa et par af de følgende Stationer* (Stat. 183 og 205) *erholdtes den kun fra Dybet, medens Havet længere Nord*

(um Jan Mayen, Beeren Island, Spitzbergen) *ofte vrimlede i Overfladen af denne Amphipode.*»

4) Calanus finmarchicus Gumm.

Es macht der Verf. keinen Unterschied zwischen dieser und C. hyperboreus Kr.

5) *Euchæta norvegica* Boeck.

In »Contributions to a Monograph of the Amphipoda Hyperiidea 1887 og 1889 hat C. Bowallius folgende Planktonformen aus dem fraglichen Meere verzeichnet:

1) Hyperoche Lütkeni Bow. = *Hyperoche Kröyeri* Bow.
2) *Hyperia medusarum* O. F. Müll.
3) *Parathemisto oblivia* Kr.
4) *Euthemisto libellula* Mandt.
5) » *compressa* Goës.

Endlich werden in »W. Kükenthal, Beiträge zur Fauna Spitzbergens, 1889»

a) von J. Vosseler unter den Amphipoden

1) *Themisto libellula* Mandt,

b) von W. Giesbrecht unter den Copepoden

2) *Calanus finmarchicus* Gunn.
3) » *hyperboreus* Kr.
4) *Enchæta norvegica* Boeck
5) Metridia armata Boeck = *Metridia longa* Lubbock

erwähnt.

Kürzlich hat G. Grönberg verschiedene *Hydromedusen* aus Spitzbergen erwähnt und beschrieben, welche, insofern sie dem »pelagischen» Plankton angehören, unten besprochen worden sind.

II.

Thiergeographische Vertheilung des animalischen Planktons des fraglichen Meeres.

Es könnte vielleicht, wenn man eine solche Meeresgegend wie die hier fragliche von rein thiergeographischem Gesichtspunkte beurtheilen will, a priori angenommen werden, die Planktonfauna sei ganz einheitlich zusammengesetzt. Eine Prüfung der thatsächlichen Verhältnisse führt aber zu einem anderen Resultat.

Noch in diesen hohen Breiten macht sich nämlich der Unterschied zwischen einheimische (*endogenetische*) Formen und Fremdlinge (*allogenetische*) geltend.

Es sind *jene* solche, die, alle Bedingungen ihres Gedeihens vorfindend, hier das Maximum ihrer Grösse und Individuenzahl erreichen. Obgleich sie aber alle als *arktisch* bezeichnet werden müssen, so können doch schon unter ihnen *zwei* Kategorien unterschieden werden, und zwar theils solche mit geringer Anpassungsfähigkeit an veränderte Lebensbedingungen (= *arktisch in engem Sinne*), theils solche mit grosser Anpassungsfähigkeit, die also eine mehr oder weniger ausgedehnte Verbreitung über die Grenzen des eigentlichen Polarwassers aus haben (= *arktisch, in weitem Sinne*).

Als Fremdlinge (*allogenetische* Formen) unter dem Plankton dieser Gegenden müssen wiederum solche betrachtet werden, deren spärliches Auftreten oder geringe Entwicklung oder beides zusammen es angeben, dass sie von ihrem Centrum aus hierher vertrieben worden sind. *So weit unsere Kenntniss der Planktonverbreitung im Atlanten gegenwärtig reicht*, können diese, je nach der Lage dieses Centrums, in *drei* Kategorien vertheilt werden, nämlich

a) solche, die in dem *Golfstromwasser*, und zwar in dem N.O. Aste desselben, heimisch sind;
b) solche, die dem *Küstenwasser des N.-Atlantischen Oceans* oder nur der östlichen Seite dieses angehören;
c) solche, die zwar auch im *Küstenwasser*, aber etwa *südlich von der Nordsee aus*, ihre Hauptverbreitung haben.

Wenn aber diese fünf Kategorien des Planktons des fraglichen Meeresabschnittes schon aus rein *thiergeographischen* Gründen sich aufstellen lassen, so fragt sich ferner nach den *hydrographischen Bedingungen* derselben.

Die Antwort ist durch die Untersuchungen der gleichzeitig mit dem Plankton genommenen Wasserproben, welche, was die drei ersten Expeditionen betrifft, von Prof. O. Petterson, und für die Antarctic-Expedition vom Doc. Dr. A. Hamberg veröffentlicht worden sind, gegeben. Und zwar kann sie so abgefasst werden, dass die Verschiedenheit des freien animalischen Lebens den *Wirkungen des N.O.-Golfstroms*, noch in den höchsten untersuchten Breiten, zuzuschreiben ist, nämlich entweder *direkt*, indem er viele ihm selbst angehörige Planktonformen gegen Norden mit sich bringt, oder *indirekt*, indem er Formen des Küstenwassers der von ihm bestrichenen Gegenden des N.W. oder sogar W. Europa's fortreisst.

Ohne auf einzelne Fälle hier einzugehen kann ich auf die theils bei der Erwähnung einer jeden Form beigefügten hydrographischen Thatsachen, theils auf die allgemeinen Fangtabellen verweisen.

I. *Arktisches* Plankton in *engem* Sinne.

Sarsia brachygaster Grönb.

Fundorte und -zeiten im N. Nordmere.

Lat. Hafen Virgo's — $\frac{\text{c. } 77^\circ\ 30'\ \text{N.}}{15^\circ\ \text{O.}}$

Long. » » — $\frac{26^\circ\ 18'\ \text{O.}}{77^\circ\ 46'\ \text{N.}}$; Anfang Juli—Ende August.

Physikalische Verhältnisse.

Temperatur: $\frac{+\ 1°.23}{30.98\ ‰} - \frac{3°.6}{33.32\ ‰}$.

Pectyllis arctica Hæckel.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{78^\circ\ 5'\ \text{N.}}{18^\circ\ 55'\ \text{O.}}$; $^{24}/_{7}$ 98.

Verbreitungsbezirk.

1) Lat. 72° 20′ N. (wenn mit Ptychogastria polaris Allmann identisch, von Lat. 81° 44′ N. ab) — N.O. Amerika.
Long. 55° 30′ W. (wenn mit Pt. polaris identisch, von Long. 65° W. ab) — 51° 15′ W.

2) $\frac{\text{Lat. } 78^\circ\ 5'\ \text{N.}}{\text{Long. } 18^\circ\ 55'\ \text{O.}}$

Solmundus glacialis Grönb.

Fundorte und -zeiten im N. Nordmeere.

Lat. Hafen Virgo's. Ende August.

Physikalische Verhältnisse.

Temperatur: + 3°.6
Salzgehalt: 33.32 ‰.

Hippocrene superciliaris L. Agass.

Fundorte und -zeiten im N. Nordmeere.

Lat. c. 77° 30′ N.
Long. c. 15° O.; erste Hälfte Juli's.

Verbreitungsbezirk.

1) Lat. 69° 15′ N. — Massachusetts Bay.
Long. 55° 5′ — 49° 45′ W.

2) Lat. c. 77° 30′ N.
Long. c. 15° O.

Catablema vesicarium (veris.) A. Agass.

Fundorte und -zeiten im N. Nordmeere.

Hafen Virgo's. Ende August.

Physikalische Verhältnisse.

Temperatur: + 3°.6
Salzgehalt: 33.32 ‰.

Tiara conifera Hæckel.

Fundorte und -zeiten im N. Nordmeere.

Lat. c. 77° 30′ N.
Long. c. 15° O.; Anfang Juli.

Verbreitungsbezirk.

1) Lat. 69° 15′ — 67° N.
Long. 53° 40′ — 52° 45′ W.

2) Lat. c. 77° 30′ N.
Long. c. 15° O.

Codonium princeps Hæck.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{\text{c. } 79^\circ\ 45'}{\text{c. } 11^\circ\ \text{O.}} - \frac{\text{c. } 78^\circ\ 30'\ \text{N.}}{\text{c. } 27^\circ\ \text{O.}}$; Anfang August.
Long.

Physikalische Verhältnisse.

Temperatur: $\frac{+\ 1^\circ.0}{32.96\ ‰}$.
Salzgehalt:

Verbreitungsbezirk.

1) Lat. 78° — 68° 43′ N.
   Long. 77° 10′ — 54° W.
2) Lat. $\frac{\text{c. } 79^\circ\ 45'}{\text{c. } 11^\circ\ \text{O.}} - \frac{\text{c. } 78^\circ\ 30'\ \text{N.}}{\text{c. } 27^\circ\ \text{O.}}$.
   Long.

Cyanea arctica (veris.) Pér. et Les.

Fundorte und -zeiten im N. Nordmeere.

Hafen Virgo's. Ende August.

Physikalische Verhältnisse.

Temperatur: $\frac{+\ 3^\circ.6}{33.32\ ‰}$.
Salzgehalt:

Verbreitungsbezirk.

1) Lat. c. 74° N. — Long Island.
   Long. Barrow Straits — 49° W.
2) Hafen Virgos (N.W. Spitzbergen).

Mertensia ovum Fabr.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{\text{c. } 79^\circ\ 45'\ \text{N.}}{\text{c. } 11^\circ\ \text{O.}}$; Ende Juli—Mitte August.
Long.

Verbreitungsbezirk.

Lat. Baffins Bay und $\frac{\text{c. } 79^\circ\ 45'\ \text{N.}}{\text{c. } 11^\circ\ \text{O.}}$ — Massachusetts Bay und Eastport.
Long. Baffins Bay — Spitzbergen.

Sagitta arctica Auriv.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{81^\circ\ 14'\ \text{N.}}{22^\circ\ 50'\ \text{O.}} - \frac{71^\circ\ 03'\ \text{N.}}{15^\circ\ 38'\ \text{O.}}$; Long. $\frac{3^\circ\ 5'\ \text{W.}}{77^\circ\ 52'\ \text{N.}} - \frac{\text{c. } 27^\circ\ \text{O.}}{\text{c. } 78^\circ\ 30'\ \text{N.}}$

Anfang Juli—Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{+1°.8}{32.96\ ‰} — \frac{+8°.5}{35.08\ ‰}$.

Verbreitungsbezirk.

1) Lat. c. 74° — c. 42° N.
   Long. 75° 30′ W. — 55° W.

2) Lat. $\frac{81° 14′ N.}{22° 50′ O.}$ — c. 58° N. (Skagerak).
   Long. $\frac{3° 5′ W.}{77° 52′ N.}$ — c. 12° O. (Skagerak).

Krohnia hamata Möbius.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{79° 58′ N.}{9° 35′ O.} — \frac{76° 36′ N.}{12° 13′ O.}$; Long. $\frac{3° 5′ W.}{77° 52′ N.} — \frac{12° 13′ O.}{76° 36′ N.}$
Ende Juli—Anfang August.

Physikalische Verhältnisse.

Nur in Vertikalfängen gefunden; die Temperatur und der Salzgehalt des Fundortes kann also nicht genau angegeben werden.

Verbreitungsbezirk.

1) Lat. 74° — 73° N.
   Long. c. 70° W.

2) Lat. $\frac{79° 58′ N.}{9° 35′ O.} — \frac{c.\ 57° 30′ N.}{c.\ 8° O.}$
   Long. $\frac{3° 5′ W.}{77° 52′ N.}$ — 12° 13′ O. (Eismeer).
   — c. 8° O. (Skagerak).

Calanus hyperboreus Kröyer.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{79° 58′ N.}{9° 35′ O.} — \frac{70° 54′ N.}{20° 43′ O.}$; Long. $\frac{3° 5′ W.}{77° 52′ N.} — \frac{20° 43′ O.}{70° 54′ N.}$
Ende Mai—Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{+1°.0}{32.96\ ‰} — \frac{+7°.15}{34.83\ ‰}$; Salzgehalt: $\frac{32.96\ ‰}{+1°.0} — \frac{35.15\ ‰}{+6°.4}$.

Verbreitungsbezirk.

1) Lat. 82° 27′ N. — 65° N.
   Long. 80° W. — c. 55° W.

2) Lat. $\frac{79°\ 58'\ N.}{9°\ 35'\ O.} — \frac{c.\ 58°\ N.}{c.\ 12°\ O.}$
   Long. $\frac{3°\ W.}{77°\ 52'\ N.} —$ 20° 43′ O. (Eismeer). / c. 12° O. (Skagerak).

Metridia longa Lubbock.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{79°\ 58'\ N.}{9°\ 35'\ O.} — \frac{76°\ 36'\ N.}{12°\ 13'\ O.}$; Long. $\frac{3°\ 5'\ W.}{77°\ 52'\ N.} — \frac{27°\ 30'\ O.}{77°\ 25'\ N.}$
Ende Juni—Ende August.

Physikalische Verhältnisse.

Temperatur: $\frac{-1°.71}{34.96\ ‰}$; übrige Beobachtungen beziehen sich auf Vertikalfänge.
Salzgehalt:

Verbreitungsbezirk.

1) Lat. 73° 33′ N. — 64° 45′ N.
   Long. 76° 59′ W. — 64° 50′ W.

2) Lat. $\frac{79°\ 58'\ N.}{9°\ 35'\ O.} — \frac{c.\ 58°\ N.}{c.\ 12°\ O.}$ (Skagerak).
   Long. $\frac{3°\ 5'\ W.}{77°\ 52'\ N.} —$ 27° 30′ O. (Eismeer). / c. 12° O. (Skagerak).

Euchæta norvegica Boeck.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{79°\ 58'\ N.}{9°\ 35'\ O.} — \frac{71°\ 03'\ N.}{15°\ 38'\ O.}$; Long. $\frac{2°\ 58'\ W.}{78°\ 13'\ N.} — \frac{19°\ 2'\ O.}{71°\ 50'\ N.}$
Ende Juli—Mitte September.

Physikalische Verhältnisse.

Temperatur: $\frac{+8°.5}{35.08\ ‰}$; die übrigen Beobachtungen beziehen sich auf Vertikalfänge.
Salzgehalt:

Verbreitungsbezirk.

1) Lat. 69° 4′ N.
   Long. 54° W.

2) Lat. $\frac{79°\ 58'\ N.}{9°\ 35'\ O.} — \frac{c.\ 58°\ N.}{c.\ 12°\ O.}$ (Skagerak).
   Long. $\frac{2°\ 58'\ W.}{78°\ 13'\ N.} —$ 19° 2′ O. (Eismeer). / c. 12° O. (Skagerak).

Euthemisto libellula Mandt.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{79°\ 58'\ N.}{9°\ 35'\ O.} — \frac{73°\ 20'\ N.}{19°\ 20'\ O.}$; Long. $\frac{3°\ 5'\ W.}{77°\ 52'\ N.} — \frac{19°\ 20'\ O.}{73°\ 20'\ N.}$

Mitte Juni — Anfang August.

Physikalische Verhältnisse.

Temperatur: $\frac{+\ 0°.24}{33.68\ ‰} — \frac{5°.70}{35\ ‰}$; Salzgehalt: $\frac{35.03\ ‰}{+\ 5°.35} — \frac{33.68\ ‰}{+\ 0°.24}$.

Verbreitungsbezirk.

1) Lat. 77° 40' N. — 64° 12' N.
   Long. c. 78° 30' W. — 51° 40' W.

2) Lat. $\frac{79°\ 58'\ N.}{9°\ 35'\ O.}$ — 66° N.
   Long. O. Grönland — Sibir. Polarmeer.

Euphausia inermis Kröyer.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{78°\ 23'\ N.}{10°\ 23'\ O.} — \frac{71°\ 03'\ N.}{15°\ 38'\ O.}$; Long. $\frac{1°\ 18'\ O.}{77°\ 39'\ N.} — \frac{15°\ 38'\ O.}{71°\ 03'\ N.}$

Ende Juli — Mitte September.

Physikalische Verhältnisse.

Temperatur: $\frac{+\ 6°.6}{34.94\ ‰} — \frac{+\ 8°.5}{35.08\ ‰}$.

Verbreitungsbezirk.

1) Lat. 69° 15' N. — c. 42° N.
   Long. 53° 30' W.

2) Lat. $\frac{78°\ 23'\ N.}{10°\ 23'\ O.}$ — c. 58° N. (Skagerak).
   Long. Jan Mayen — Karisches Meer. — 12° O. (Skagerak).

Limacina helicina Phipps.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{81°\ 14'\ N.}{22°\ 50'\ O.} — \frac{73°\ 58'\ N.}{19°\ 3'\ O.}$; Long. $\frac{3°\ 5'\ W.}{77°\ 52'\ N.} — \frac{22°\ 50'\ O.}{81°\ 14'\ N.}$

Anfang Juli — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{+1°.0}{32.96\ ‰} — \frac{+5°.08}{34.67\ ‰}$; Salzgehalt: $\frac{34.67\ ‰}{+5°.08} — \frac{32.96\ ‰}{+1°.0}$.

Verbreitungsbezirk.

1) Lat. 78° 15′ N. — 62° N.
   Long. 74° 15′ W. — 54° 28′ W.

2) Lat. $\frac{81°\ 14'\ N.}{22°\ 50'\ O.}$ — N. Küste Norwegens.
   Long. Jan Mayen — N. Semlja.

Clione limacina Phipps.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{78°\ 15'\ N.}{15°\ 30'\ O.} — \frac{73°\ 58'\ N.}{19°\ 3'\ O.}$; Mitte Juli — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{+3°.6}{33.32\ ‰} — \frac{+5°.8}{34.67\ ‰}$.

Verbreitungsbezirk.

1) Lat. 81° 44′ N. — 42° N.
   Long. 77° 10′ W. — 49° 45′ W.

2) Lat. $\frac{78°\ 15'\ N.}{15°\ 30'\ O.}$ — c. 56° N. (Nordsee).
   Long. 15° 30′ O. — $\begin{cases} \frac{68°\ 59'\ O.}{73°\ 0'\ N.} \text{ (Karisches Meer).} \\ \text{c. } 12°\ O. \text{ (Skagerak).} \end{cases}$

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2. *Arktisches* Plankton. in *weitem* Sinne.

Globigerina bulloides d'Orb.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{81°\ 14'}{22°\ 50'\ O.} — \frac{71°\ 14'}{19°\ 38'\ O.}$; Long. $\frac{3°\ 5'\ W.}{77°\ 52'\ N.} — \frac{22°\ 50'\ O.}{81°\ 14'\ N.}$
Anfang Juni — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{3°.63'}{34.38\ ‰} — \frac{9°.40}{34.92\ ‰}$; Salzgehalt: $\frac{34.34\ ‰\ (\text{in } 3000\text{ m.})}{5°.53} — \frac{35.25\ ‰}{5°.53}$.

Verbreitungsbezirk.

1) Lat. 68° 21′ N. — 64° 45′ N.
Long. 64° 50′ W. — 62° 58′ W.

2) Lat. $\frac{81° 14'}{22° 50' O.}$ — $\frac{57° 30'}{11° 5' W.}$.

Long. $\frac{3° 5' W.}{77° 52' N.}$ — $\frac{22° 50' O.}{81° 14' N.}$ (Eismeer).
$\frac{11° 5' W.}{57° 30' N.}$ — c. 12° O. (Skagerak).

Plagiacantha arachnoides Clap.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{79° 58' N.}{9° 35' O.}$ — $\frac{72° 29' N.}{18° 48' O.}$; Long. $\frac{4° 45' O.}{79° N.}$ — $\frac{18° 50' O.}{73° 36' N.}$

Anfang August — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{4°.82}{34.57\ ‰}$ — $\frac{8°.87}{35.04\ ‰}$; Salzgehalt: $\frac{34.57\ ‰}{4°.82}$ — $\frac{35{,}17\ ‰}{7°.24}$.

Verbreitungsbezirk.

Lat. $\frac{79° 58' N.}{9° 35' O.}$ — 58° N. (Skagerak).

Long. $\frac{4° 45' O.}{79° N.}$ — $\frac{18° 50' O.}{73° 36' N.}$ (Eismeer).
c. 12° O. (Skagerak).

Litholophus arcticus Auriv.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{79° 58' N.}{9° 35' O.}$ — $\frac{71° 14' N.}{19° 38' O.}$; Long. $\frac{3°.5\ W.}{77° 52' N.}$ — $\frac{19° 38' O.}{71° 14' N.}$

Ende Mai — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{4°.2}{33.71\ ‰}$ — $\frac{9°.40}{34.92\ ‰}$; Salzgehalt: $\frac{33.71\ ‰}{4°.2}$ — $\frac{35.03\ ‰}{7°.06}$.

Verbreitungsbezirk.

1) Lat. 75° 32′ N. — 65° N.
   Long. 80° W. — 64° 40′ W.

2) Lat. $\frac{79° 58′ \text{ N.}}{9° 35′ \text{ O.}}$ — c. 58° N. (Skagerak).
   Long. $\frac{3° 5′ \text{ W.}}{77° 52′ \text{ N.}}$ — $\begin{cases} \frac{19° 38′ \text{ O.}}{71° 14′ \text{ N.}} \\ \text{c. } 12° \text{ O. (Skagerak).} \end{cases}$

Peridinium ovatum Pouchet.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{81° 14′ \text{ N.}}{22° 50′ \text{ O.}} - \frac{71° 50′ \text{ N.}}{19° 2′ \text{ O.}}$; Long. $\frac{3° 5′ \text{ W.}}{77° 52′ \text{ N.}} - \frac{22° 50′ \text{ O.}}{81° 14′ \text{ N.}}$

Anfang Juli — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{2°.42}{33.93\ ‰} - \frac{6°.61}{35.13\ ‰}$; Salzgehalt: $\frac{33.71\ ‰}{4°.2} - \frac{35.13\ ‰}{6°.61}$.

Verbreitungsbezirk.

Lat. $\frac{81° 14′ \text{ N.}}{22° 50′ \text{ O.}}$ — Mittelmeer.

Long. $\frac{3° 5′ \text{ W.}}{77° 52′ \text{ N.}}$ $\begin{cases} \frac{22° 50′ \text{ O.}}{81° 14′ \text{ N.}} \text{ (Eismeer).} \\ \text{c. } 12° \text{ O. (Skagerak).} \\ \text{c. } 6° \text{ O. (Mittelmeer).} \end{cases}$

Peridinium pellucidum Bergh.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{81° 14′ \text{ N.}}{22° 50′ \text{ O.}} - \frac{71° 50′ \text{ N.}}{19° 2′ \text{ O.}}$; Long. $\frac{3° 5′ \text{ W.}}{77° 52′ \text{ N.}} - \frac{30° 15′ \text{ O.}}{80° 27′ \text{ N.}}$

Mitte Juli — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{-0°.90}{32.03\ ‰} - \frac{5°.20}{34.93\ ‰}$.
Salzgehalt:

Verbreitungsbezirk.

Lat. $\frac{81^\circ\ 14'\ \text{N.}}{22^\circ\ 50'\ \text{O.}}$ — Mittelmeer.

Long. $\left\{\frac{3^\circ\ 5'\ \text{W.}}{77^\circ\ 52'\ \text{N.}}\right\}$ — $\left\{\begin{array}{l}\frac{30^\circ\ 15'\ \text{O.}}{80^\circ\ 27'\ \text{N.}}\ \text{(Eismeer).}\\ \text{c. } 12^\circ\ \text{O. (Skagerak).}\\ \text{c. } 14^\circ\ \text{O. (Mittelmeer).}\end{array}\right.$

Bemerkung. Es scheint diese Form, nach den vorliegenden Funden zu urtheilen, ungefähr dieselbe Verbreitung wie P. ovatum zu haben.

Peridinium divergens Ehrbg. var. depressa Bailey.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{80^\circ\ 8'\ \text{N.}}{16^\circ\ 32'\ \text{O.}}$ — $\frac{69^\circ\ 45'\ \text{N.}}{17^\circ\ 45'\ \text{O.}}$; Long. $\frac{3^\circ\ 20'\ \text{O.}}{78^\circ\ 48'\ \text{N.}}$ — $\frac{22^\circ\ 35'\ \text{O.}}{71^\circ\ 42'\ \text{N.}}$

Ende Mai — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{+\ 1^\circ.56}{33.42\ ^0/_{00}}$ — $\frac{9^\circ.40}{34.92\ ^0/_{00}}$; Salzgehalt: $\frac{33.42\ ^0/_{00}}{1^\circ.56}$ — $\frac{35.17\ ^0/_{00}}{7^\circ.55}$.

Verbreitungsbezirk.

1) $\left\{\begin{array}{ll}\text{Lat.} & \text{c. } 78^\circ\ \text{N.} — \text{c. } 40^\circ\ \text{N.}\\ \text{Long.} & 80^\circ\ \text{W.} — 61^\circ\ 20'\ \text{W.}\end{array}\right.$

2) $\left\{\begin{array}{ll}\text{Lat.} & \frac{80^\circ\ 8'\ \text{N.}}{16^\circ\ 32'\ \text{O.}} — \text{c. } 48^\circ\ \text{N.}\\ \text{Long.} & \frac{3^\circ\ 20'\ \text{O.}}{78^\circ\ 48'\ \text{N.}} — \left\{\begin{array}{l}\frac{22^\circ\ 35'\ \text{O.}}{71^\circ\ 12'\ \text{N.}}\ \text{(Eismeer).}\\ \text{Skagerak.}\end{array}\right.\end{array}\right.$

Ceratium tripus O. F. Müll. var. arctica Ehrbg.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{81^\circ\ 14'\ \text{N.}}{22^\circ\ 50'\ \text{O.}}$ — $\frac{70^\circ\ 23'\ \text{N.}}{20^\circ\ 32'\ \text{O.}}$; Long. $\frac{3^\circ\ 5'\ \text{W.}}{77^\circ\ 52'\ \text{N.}}$ — $\frac{34^\circ\ 30'\ \text{O.}}{78^\circ\ 38'\ \text{N.}}$

Anfang Juni — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{-\ 0^\circ.90}{32.03\ ^0/_{00}}$ — $\frac{+\ 9^\circ.68}{34.41\ ^0/_{00}}$; Salzgehalt: $\frac{32.03\ ^0/_{00}}{-\ 0^\circ.90}$ — $\frac{35.17\ ^0/_{00}}{+\ 7^\circ.24}$.

Verbreitungsbezirk.

1) Lat. 79° N. — 64° 30′ N.
   Long. 80° W. — 54° 30′ W.

2) Lat. $\frac{81° 14′ \text{ N.}}{22° 50′ \text{ O.}}$ — Mittelmeer; (forma tergestina!)

   Long. $\frac{3° 5′ \text{ W.}}{77° 52′ \text{ N.}}$ — 34° 30′ O. (Eismeer).
   15° O. (Baltisches Meer).
   14° O. (Adriatisches Meer; forma tergestina!).

Tintinnus (Cyttarocylis) denticulatus Ehrbg.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{80° 27′ \text{ N.}}{30° 15′ \text{ O.}} — \frac{70° 23′ \text{ N.}}{20° 32′ \text{ O.}}$; Long. $\frac{3° 5′ \text{ W.}}{77° 52′ \text{ N.}} — \frac{34° 30′ \text{ O.}}{78° 38′ \text{ N.}}$

Mitte Juni — Mitte September.

Physikalische Verhältnisse.

Temperatur: $\frac{-0°.90}{32.03\ ‰} — \frac{9°.68}{34.41\ ‰}$; Salzgehalt: $\frac{30.98\ ‰}{1°.23} — \frac{35.15\ ‰}{6°.40}$.

Verbreitungsbezirk.

1) Lat. 76° 9′ N. — New England.
   Long. 75° 30′ W. — 55° W.

2) Lat. $\frac{80° 27′ \text{ N.}}{30° 15′ \text{ O.}}$ — Nordsee.

   Long. $\frac{3° 5′ \text{ W.}}{77° 52′ \text{ N.}}$ — $\frac{34° 30′ \text{ O.}}{78° 38′ \text{ N.}}$ (Eismeer).
   c. 13° O. (Ostsee).

Bemerkung. Es ist unter dem obenstehenden Namen auch die *Cyttarocylis gigantea* Brandt mit einbegriffen, welche, meines Erachtens, durch die angegebenen Merkmale wenigstens als Art nicht unterschieden werden kann. Die mehr bedeutende Grösse der Hülse und die grössere Anzahl der Zähne dürften vielleicht, wo sie — wie im N. Nordmeere — häufig vorkommen, auf das Verbreitungscentrum der Art hindeuten.

Tintinnus denticulatus Ehrbg. var. obtusa n. var.

Die Hülse nach hinten quer abgerundet (nicht, wie bei der Hauptform verschmälert, spitz auslaufend), im Centrum des Hinterendes gewöhnlich ein wenig ausgehöhlt. Übrigens in Form und Skulptur der Hauptform ähnlich.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{80° 27′ \text{ N.}}{30° 15′ \text{ O.}} — \frac{76° 27′ \text{ N.}}{25° 55′ \text{ O.}}$ Long. $\frac{30° 15′ \text{ O.}}{80° 27′} — \frac{34° 30′ \text{ O.}}{78° 38′ \text{ N.}}$

Ende Juni—Mitte August

Physikalische Verhältnisse.

Temperatur: $\frac{-0°.90}{32.03\ ‰} — \frac{+1°.55}{33.20\ ‰}$; Salzgehalt: $\frac{32.03\ ‰}{-0°.90} — \frac{33.68\ ‰}{+0°.24}$.

Tintinnus (Cyttarocylis) edentatus Brandt.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{81°\ 14'\ N.}{22°\ 50'\ O.} — \frac{71°\ 50'\ N.}{19°\ 2'\ O.}$; Long. $\frac{3°\ 5'\ W.}{77°\ 52'\ N.} — \frac{22°\ 50'\ O.}{81°\ 14'\ N.}$

Ende Juli — Anfang September.

Physikalische Verhältnisse.

Temperatur: $2°.42$
Salzgehalt: $\frac{}{33.93\ ‰} — \frac{7°.24}{35.17\ ‰}$.

Verbreitungsbezirk.

1) Lat. Davis' Strait — { Labradorstrom; 23.—30. Juli. / Irminger See;
2) Im »Nördlichen Ast des Golfstroms; 20.—21. Juli.
3) Siehe oben!

Bemerkung. Unter dem vorliegenden Materiale finden sich mehrere Exemplare, deren Form zwar an diejenige des *T. edentatus* erinnert, deren Hülsenrand aber von circa 30 scharfen Zähnen besetzt und deren Hinterende mitunter mit der Anlage eines Stachels versehen ist.

Tintinnus (Ptychocylis) urnula Cl. et Lachm.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{71°\ 50'\ N.}{19°\ 2'\ O.} — \frac{71°\ 57'\ N.}{19°\ 0'\ O.}$; 5. September 1898.

Physikalische Verhältnisse.

Temperatur: $9°.08$
Salzgehalt: $\frac{}{34.96\ ‰}$.

Tintinnus urnula Cl. var. digitale Auriv.
(= Ptychocylis arctica Brandt).

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{75°\ 35'\ N.}{15°\ 0'\ O.}$; 9. September 1896.

Verbreitungsbezirk.

1) Davis' Strait 6.—7. September 1893 (Brandt).
2) Baffins Bay und Davis' Strait (Aurivillius).
3) Spitzbergen (siehe oben).

Tintinnus (Ptychocylis) acuta Brandt.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{81°\ 8'\ \text{N.}}{23°\ 35'\ \text{O.}} - \frac{71°\ 50'\ \text{N.}}{19°\ 2'\ \text{O.}}$; Long. $\frac{9°\ 25'\ \text{O.}}{79°\ 32'\ \text{N.}} - \frac{23°\ 35'\ \text{O.}}{81°\ 8'\ \text{N.}}$

Ende August — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{+\ 0°.71}{32.84\ ‰} - \frac{8°.87}{35.04\ ‰}$; Salzgehalt: $\frac{32.84\ ‰}{+\ 0°.71} - \frac{35.17\ ‰}{7°.24}$.

Verbreitungsbezirk.

1) Davis' Strait und Karajakfjord bis Irminger See (Brandt).
2) Siehe oben!

Tintinnus (Ptychocylis) obtusa Brandt (incl. Ptych. Drygalski Brandt).

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{81°\ 14'\ \text{N.}}{22°\ 50'\ \text{O.}} - \frac{73°\ 36'\ \text{N.}}{18°\ 50'\ \text{O.}}$; Long. $\frac{3°\ 5'\ \text{W.}}{77°\ 52'\ \text{N.}} - \frac{34°\ 30'\ \text{O.}}{78°\ 38'\ \text{N.}}$

Ende Juni — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{-\ 0°.90}{32.03\ ‰} - \frac{7°.07}{35.03\ ‰}$.
Salzgehalt:

Verbreitungsbezirk.

1) Davis' Strait und Karajakfjord bis N. Foundland (Brandt).
2) Siehe oben!

Bemerkung. Es ist mir nicht möglich gewesen sichere Unterscheidungsmerkmale zwischen *P. Drygalski* und *P. obtusa* zu finden.

Tintinnus norvegicus Daday.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{75°\ 30'\ \text{N.}}{15°\ 20'\ \text{O.}} - \frac{75°\ 35'\ \text{N.}}{15°\ \text{O.}}$ 9. September 1896.
Long.

Verbreitungsbezirk.

1) Lat. 71° 52' N. — 68° 21' N.
   Long. 73° 47' W. — 62° 58' W.

2) Lat. $\frac{75° 35' \text{ N.}}{15° \text{ O.}}$ — c. 60° (W. Küste Norwegens).
Long. c. 5° (W. Küste Norwegens) — $\frac{15° 20' \text{ O.}}{75° 30' \text{ N.}}$

Tintinnus secatus Brandt.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{79° 58' \text{ N.}}{9° 35' \text{ O.}} — \frac{75° 30' \text{ N.}}{15° 20' \text{ O.}}$; Long. $\frac{9° 35' \text{ O.}}{79° 58' \text{ N.}} — \frac{15° 25' \text{ O.}}{75° 50' \text{ N.}}$

Ende August — Anfang September.

Physikalische Verhältnisse.

Temperatur: $5°.35$
Salzgehalt: $35.03\ ‰$; übrigens Vertikalfänge.

Verbreitungsbezirk.

1) Davis' Strait und Karajakfjord (Brandt).
2) Siehe oben!

Pleurobrachia pileus Fabr.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{79° 45' \text{ N.}}{\text{c. } 11° \text{ O.}} — \frac{77° 30' \text{ N.}}{\text{c. } 15° \text{ O.}}$

Verbreitungsbezirk.

1) Lat. 82° 25' N. — 32° N. (Bermuda).
Long. c. 75° 30' W. — 49° 45' W.

2) Lat. $\frac{79° 45' \text{ N.}}{\text{c. } 11° \text{ O.}}$ — Nordsee.
Long. $\frac{\text{c. } 11° \text{ O.}}{79° 45' \text{ N.}} — \begin{cases} \frac{\text{c. } 15° \text{ O.}}{77° 30' \text{ N.}} \\ \text{W. Ostsee.} \end{cases}$

Beroe cucumis Fabr.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{78° 15' \text{ N.}}{15° 30' \text{ O.}} — \frac{\text{c. } 77° 30' \text{ N.}}{\text{c. } 15° \text{ O.}}$; Long. $\frac{1° 18' \text{ O.}}{77° 39' \text{ N.}} — \frac{15° 30' \text{ O.}}{78° 15' \text{ N.}}$

Verbreitungsbezirk.

1) Lat. 78° N. — c. 42° N.
   Long. 70° 30′ W. — 49° 45′ W.

2) Lat. $\frac{78° 15′ N.}{15° 30′ O.}$ — Nordsee.
   Long. $\frac{1° 18′ O.}{78° 39′ N.}$ — $\left\{\begin{array}{l}\frac{15° 30′ O.}{78° 15′ N.}\\ \text{W. Ostsee.}\end{array}\right.$

Calanus finmarchicus Gunn.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{81° 14′ N.}{22° 50′ O.} — \frac{69° 45′ N.}{17° 45′ O.}$; Long. $\frac{3° 5′ W.}{77° 52′ N.} — \frac{34° 30′ O.}{78° 38′ N.}$

Ende Mai — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{-0°.90}{32.03\ ‰} — \frac{9°.40}{34.92\ ‰}$; Salzgehalt: $\frac{30.98\ ‰}{1°.23} — \frac{35.15\ ‰}{6°.26}$.

Verbreitungsbezirk.

Lat. $\frac{81° 14′ N.}{22° 50′ O.}$ — 52° S.

Long. 74° 32′ W. (im Grönl. Meere). — $\left\{\begin{array}{l}\text{N. Semlja (H. J. Hansen).}\\ \text{14° O. (Ostsee, Mittelmeer).}\end{array}\right.$

Pseudocalanus elongatus Boeck.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{79° 58′ N.}{9° 35′ O.} — \frac{71° 03′ N.}{15° 38′ O.}$; Long. $\frac{3° 5′ W.}{77° 52′ N.} — \frac{27° 30′ O.}{77° 25′ N.}$

Ende Juni — Mitte September.

Physikalische Verhältnisse.

Temperatur: $\frac{-1°.71}{34.96\ ‰} — \frac{+8°.5}{35.08\ ‰}$; Salzgehalt: $\frac{34.36\ ‰}{2°.83} — \frac{35.08\ ‰}{8°.5}$.

Verbreitungsbezirk.

1) Lat. 75° 32′ N. — 64° 30′ N.
   Long. 70° W. — 54° 28′ W.

2) Lat. $\frac{79° 58′ N.}{9° 35′ O.}$ — 50° N.
   Long. $\left\{\begin{array}{l}\frac{3° 5′ W.}{77° 52′ N.}\\ \frac{5° 51′ W.}{60° 3′ N.}\end{array}\right\}$ — $\left\{\begin{array}{l}\frac{27° 30′ O.}{77° 25′ N.}\ \text{(Eismeer).}\\ \text{24° O. Baltisches Meer.}\end{array}\right.$

Microsetella atlantica Brady et Rab.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{79° 20' \text{ N.}}{7° 45' \text{ O.}} — \frac{70° 45' \text{ N.}}{20° 3' \text{ O.}}$
Long.
Mitte Juli — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{3°.03}{33.47\ ‰} — \frac{9°.68}{34.41\ ‰}$; Salzgehalt: $\frac{33.47\ ‰}{3°.03} — \frac{35.15\ ‰}{6°.26}$.

Verbreitungsbezirk.

1) Lat. c. 72° — c. 65° 30' N.
   Long. c. 74° — c. 61° W.

2) Lat. $\frac{79° 20' \text{ N.}}{7° 45' \text{ O.}}$ — 6° N.
   Long. $\frac{15° \text{ W.}}{53° 24' \text{ N.}}$ — $\frac{20° 3' \text{ O.}}{70° 45' \text{ N.}}$ (Eismeer). / c. 12° O. (Skagerak). / c. 14° O. (Mittelmeer).

Parathemisto oblivia Kröyer.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{79° 58' \text{ N.}}{9° 35' \text{ O.}} — \frac{71° 03' \text{ N.}}{15° 38' \text{ O.}}$; Long. $\frac{3° 5' \text{ W.}}{77° 52' \text{ N.}} — \frac{19° 2' \text{ O.}}{71° 50' \text{ N.}}$
Ende Juli — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{6°.61}{35.13\ ‰} — \frac{8°.5}{35.08\ ‰}$; im übrigen Angaben über Vertikalfänge.

Verbreitungsbezirk.

Lat. Westküste Grönlands. / Jan Mayen. / $\frac{79° 58' \text{ N.}}{9° 35' \text{ O.}}$ (Oberfläche!) — Lat. $\frac{44° 17' \text{ N.}}{4° 38' \text{ O.}}$ (Tiefe!)

Long. Westküste Grönlands — Murman. Meer. / c. 12° O. (Skagerak).

Hyperoche Kröyeri Bowall.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{71° 14' \text{ N.}}{19° 38' \text{ O.}}$ 5. September 1898.

Physikalische Verhältnisse.

Temperatur: $\frac{9°.40}{34.12\ ‰}$.

Verbreitungsbezirk.

1) Lat. 69° 15' N. — Labrador.
Long. 53° W. — 51° W.

2) Lat. $\left\{\frac{74° 36' \text{ N.}}{12° \text{ W.}}\right\}$ — c. 58° N. (Skagerak).
Spitzbergen
Long. $\frac{12° \text{ W.}}{74° 36' \text{ N.}}$ — Sibirisches Polarmeer. c. 12° O. (Skagerak).

Hyperia galba Mont.

Fundorte und -zeiten im N. Nordmeere.

Hafen Virgo's. 26.—27. August.

Physikalische Verhältnisse.

Temperatur: $\frac{+ 3°.6}{33.32\ ‰}$.

Verbreitungsbezirk.

Lat. c. 70° 50' N. (W. Grönl. Meer) / Spitzbergen — c. 48° N. (Westküste Frankreichs).

Long. 54° 15' W. (W. Grönl. Meer) — Karisches Meer. c. 12° O. (Skagerak).

Limacina balea Möller.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{75° 42' \text{ N.}}{15° \text{ O.}} - \frac{70° 45' \text{ N.}}{20° 3' \text{ N.}}$; Ende August — Anfang September.
Long.

Physikalische Verhältnisse.

Temperatur: $\frac{9°}{34.93\ ‰} - \frac{9°.68}{34.41\ ‰}$.
Salzgehalt:

Verbreitungsbezirk.

1) Lat. Davis' Strait — c. 42° N.
   Long. 70°.

2) Lat. $\frac{75°\ 42'\ N.}{15°\ O.}$ — c. 40° N. (Azoren).
   Long. $\left\{\begin{array}{l}15°\ O.\\ 75°\ 42'\ N.\\ \text{Westküste Norwegens}\\ \text{c. 2° W. (Biskaya Bay)}\end{array}\right\}$ — $\left\{\begin{array}{l}\text{N. Norwegen.}\\ \text{c. 12° O. (Skagerak).}\end{array}\right.$

Oikopleura Vanhöffeni Lohm.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{78°\ 30'\ N.}{27°\ O.} — \frac{74°\ 18'\ N.}{17°\ 50'\ O.}$; Long. $\frac{c.\ 15°\ O.}{77°\ 30'\ N.} — \frac{27°\ O.}{78°\ 30'\ N.}$

Anfang Juli — Anfang September.

Physikalische Verhaltnisse.

Temperatur: $\frac{+\ 1°}{32.96\ ‰} — 4°.5$; Salzgehalt: $\frac{32.96\ ‰}{+\ 1°} — \frac{34.83\ ‰}{3°.7}$

Fritillaria borealis Lohm.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{81°\ 14'\ N.}{22°\ 50'\ O.} — \frac{73°\ 36'\ N.}{18°\ 58'\ O.}$; Long. $\frac{3°\ 5'\ W.}{77°\ 52'\ N.} — \frac{32°\ 53'\ O.}{77°\ 48'\ N.}$

Ende August.

Physikalische Verhältnisse.

Temperatur: $\frac{-\ 0°.90}{32.03\ ‰} — \frac{7°.06}{35.03\ ‰}$; Salzgehalt: $\frac{32.03\ ‰}{-\ 0°.90} — \frac{35.13\ ‰}{6°.61}$.

Verbreitungsbezirk.

1) Lat. Smith Sound — c. 45° (N. Foundland).
   Long. 75° W. — c. 30° W.

2) Lat. $\frac{81°\ 14'\ N.}{22°\ 50'\ O.}$ — S. Nordsee.
   Long. $\frac{3°\ 5'\ W.}{77°\ 52'\ N.}$ — $\left\{\begin{array}{l}\frac{32°\ 53'\ O.}{77°\ 48'\ N.}\ \text{(Eismeer).}\\ \text{c. 12° O. (Skagerak).}\end{array}\right.$

3. Golfstromplankton.

Acanthonia quadrifolia Hæckel.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{71° 50' \text{ N.}}{19° 2' \text{ O.}} — \frac{72° 43' \text{ N.}}{18° 43' \text{ O.}}$; Anfang September.
Long.

Physikalische Verhältnisse.

Temperatur: $\frac{8°.8}{35.01\ ‰} — \frac{9°.8}{34.96\ ‰}$.
Salzgehalt:

Verbreitungsbezirk.

Lat. Mittelmeer — $\frac{72° 43' \text{ N.}}{18° 43' \text{ O.}}$

Long. c. 5° W. (Färökanal) — $\begin{cases} \frac{19° 2' \text{ O.}}{71° 50' \text{ N.}} \text{ (Eismeer).} \\ 12° \text{ O. (Skagerak).} \\ 15° \text{ O. (Mittelmeer).} \end{cases}$

Acanthostaurus pallidus Cl. et Lachm.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{71° 23' \text{ N.}}{15° 30' \text{ O.}} — \frac{75° 50' \text{ N.}}{15° 25' \text{ O.}}$; Long. $\frac{15° 25' \text{ O.}}{75° 50' \text{ N.}} — \frac{19° 2' \text{ O.}}{71° 50' \text{ N.}}$
Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{8°.87}{35.04\ ‰} — \frac{9°.08}{34.96\ ‰}$.
Salzgehalt:

Verbreitungsbezirk.

Lat. $\begin{cases} 60° 3' \text{ N. (Färökanal)} \\ \text{c. } 58° \text{ N. (Skagerak)} \end{cases} — \frac{75° 50' \text{ N,}}{15° 25' \text{ O.}}$

Long. $\begin{cases} 5° 51' \text{ W. (Färökanal)} — \text{c. } 12° \text{ O. (Skagerak).} \\ \frac{15° 25' \text{ O.}}{75° 50' \text{ N.}} — \frac{19° 2' \text{ O.}}{71° 50 \text{ N.}} \end{cases}$

Acanthonia tetracopa J. Müller.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{76° 12' \text{ N.}}{12° 18' \text{ O.}} — \frac{79° 58' \text{ N.}}{9° 35' \text{ O.}}$; Long. $\frac{3° 5' \text{ W.}}{77° 52' \text{ N.}} — \frac{12° 18' \text{ O.}}{76° 12' \text{ N.}}$

Ende Juli — Ende August.

Physikalische Verhältnisse.

Temperatur: $\frac{6°.26}{35.15\ ‰}$; übrige Angaben beziehen sich auf Vertikalfänge.
Salzgehalt:

Verbreitungsbezirk.

»Kosmopolitan: Mediterranean, Atlantic, Indian, Pacific, many stations, surface» (Hæckel, in Challenger Rep.).

Collozoum inerme (veris.) J. Müller.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{70° 54' \text{ N.}}{20° 43' \text{ O.}} — \frac{77° 52' \text{ N.}}{3° 5' \text{ W.}}$; Long. $\frac{3° 5' \text{ W.}}{77° 52' \text{ N.}} — \frac{22° 35' \text{ O.}}{71° 42' \text{ N.}}$

Anfang Juni — Ende Juli.

Challengeria tridens Hæck.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{71° 50' \text{ N.}}{19° 2' \text{ O.}} — \frac{81° 14' \text{ N.}}{22° 50' \text{ O.}}$; Long. $\frac{9° 35' \text{ O.}}{79° 58' \text{ N.}} — \frac{22° 50' \text{ O.}}{81° 14' \text{ N.}}$

Anfang August — Anfang September.

Physikalische Verhältnisse.

Alle Angaben beziehen sich auf Vertikalfänge.

Verbreitungsbezirk.

Lat. Färökanal $— \frac{81° 14' \text{ N.}}{22° 50' \text{ O.}}$

Long. $\left\{\begin{matrix} \text{c. } 5° \text{ W. (Färökanal)} \\ 9° 35' \text{ N.} \\ \hline 79° 58' \text{ N.} \end{matrix}\right\} — \frac{22° 50' \text{ O.}}{81° 14' \text{ N.}}$

Rhizoplegma sp.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{75° 50' \text{ N.}}{15° 25' \text{ O.}} — \frac{79° 58' \text{ N.}}{9° 35' \text{ O.}}$

Ende August — Anfang September; in Vertikalfängen von 0—400 Meter.

Die Markschale mit unregelmässigen Maschen. Radiärstacheln wenigstens 8, dreieckig; die freien Theile derselben etwas grösser als der Diameter der Schale. Die Rindenschale auf die Stacheln hinauslaufend; distal davon finden sich auf den Stacheln einander schief gegenüber stehende paarige Dörnchen.

Lithomelissa thoracites Hæck.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{75° 50' \text{ N.}}{15° 25' \text{ O.}} — \frac{78° 13' \text{ N.}}{2° 58' \text{ W.}}$; Long. $\frac{3° 5' \text{ W.}}{77° 52' \text{ N.}} — \frac{15° 25' \text{ O.}}{75° 50' \text{ N.}}$

Anfang Juli — Anfang September.

Physikalische Verhältnisse.

Temperatur: $+ 3°.63$
Salzgehalt: $34.38\ ‰$.

Aglantha digitale O. F. Müller.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{78° 13' \text{ N.}}{2° 58' \text{ W.}}$; Ende Juli.
Long.

Verbreitungsbezirk.

Lat. c. 39° N. (New England) — $\begin{cases} 78° \text{ N. (W. Grönl. Meer).} \\ \frac{78° 13' \text{ N.}}{2° 58' \text{ O.}} \text{ (N. Nordmeer).} \end{cases}$

Long. 77° 10' W. (Amerik. Küste) — $\begin{cases} \frac{2° 58' \text{ W.}}{78° 13' \text{ N.}} \text{ (N. Nordmeer).} \\ \text{c. } 8° \text{ O. (Nordsee und W. Skagerak).} \end{cases}$

Oneæa minuta Giesbr.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{75° 50' \text{ N.}}{15° 25' \text{ O.}} — \frac{78° 13' \text{ N.}}{2° 58' \text{ O.}}$; Long. $\frac{3° 5' \text{ W.}}{77° 52' \text{ N.}} — \frac{15° 25' \text{ O.}}{75° 50' \text{ N.}}$

Anfang September (in einem Vertikalfang von 0—25 Meter).

Physikalische Verhältnisse.

Temperatur: $\frac{+\ 3°.63}{34.38\ ‰} — \frac{2°.72}{34.74\ ‰}$.

Übrige Angaben beziehen sich auf Vertikalfänge von 0 bis auf 325 Met. Tiefe.

Männchen (bisher unbekannt).

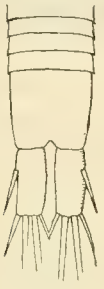

Fig. 1.

Fig. 2.

Fig. 3.

Diagn. Furca (Fig. 1) kürzer als das letzte Abdominalsegment. Die Äste der Furca an einander genähert; die Länge derselben etwa doppelt so gross als die Breite an der Basis. Im Ende des Genitalsegmentes steckt ein kurzes dreigespaltetes Dörnchen.

Von demjenigen der *O. media* dadurch verschieden, dass der Zapfen des R i. — wenigstens beim 2. und 3. Fusse — schwach hakenähnlich gebogen und etwa so lang wie $^1/_3$ des langen Endstachels aber etwas länger als die Hälfte des kleineren Stachels ist (Fig. 2). Der Zapfen des 4. Fusspaares macht nur etwa $^1/_9$ des grösseren und $^1/_6$ des kleineren Endstachels aus.

Hintere Maxillarfüsse (Fig. 3): der Innenrand des B 2. feinhaarig (nicht gezähnt, wie bei *O. conifera* ♂). Der distale Drittheil der Klaue gegen den übrigen Theil fast knieförmig gebogen (bei *O. conifera* ♂ ist die *ganze* Klaue fast ebenmässig gekrümmt).

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4. N. Atlantisches Küstenplankton.

Peridinium divergens Ehrbg.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{70°\ 23'\ \text{N.}}{20°\ 32'\ \text{O.}} — \frac{75°\ 35'\ \text{N.}}{15°\ \text{O.}}$; Long. $\frac{15°\ \text{O.}}{75°\ 35'\ \text{N.}} — \frac{22°\ 35'\ \text{O.}}{71°\ 42'\ \text{N.}}$

Anfang Juni — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{+\ 6°.40}{35.15\ ‰} — \frac{+\ 9°.37}{34.41\ ‰}$.

Verbreitungsbezirk.

Lat. Mittelmeer — $\begin{cases} \frac{75^\circ\ 35'\ \text{N.}}{15^\circ\ \text{O.}}\ \text{(Eismeer).} \\ \text{c. } 60^\circ\ \text{(Baltisches Meer).} \end{cases}$

Long. $\frac{7^\circ\ 11'\ \text{W.}}{60^\circ\ 2'\ \text{N.}}$ — $\begin{cases} \frac{22^\circ\ 35'\ \text{O.}}{71^\circ\ 42'\ \text{N.}}\ \text{(Eismeer).} \\ \text{c. } 25^\circ\ \text{O. (Baltisches Meer).} \end{cases}$

Ceratium tripus O. F. Müller.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{70^\circ\ 23'\ \text{N.}}{20^\circ\ 32'\ \text{O.}}$ — $\frac{77^\circ\ 39'\ \text{N.}}{1^\circ\ 18'\ \text{O.}}$

Anfang Juni; Ende Juli — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{+\ 6^\circ.71}{35.20\ ‰}$ — $\frac{+\ 9^\circ.68}{34.41\ ‰}$.

Verbreitungsbezirk.

Lat. Mittelmeer — $\frac{77^\circ\ 39'\ \text{N.}}{1^\circ\ 18'\ \text{O.}}$

Long. c. 50° W. (Labradorstrom) — $\begin{cases} \frac{20^\circ\ 32'\ \text{O.}}{70^\circ\ 23'\ \text{N.}}\ \text{(Eismeer).} \\ \text{c. } 25^\circ\ \text{O. (Baltisches Meer).} \\ \text{c. } 15^\circ\ \text{O. (Mittelmeer).} \end{cases}$

Ceratium tripus O. F. M. var. macroceros Ehrbg.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{70^\circ\ 23'\ \text{N.}}{20^\circ\ 32'\ \text{O.}}$ — $\frac{73^\circ\ 15'\ \text{N.}}{18^\circ\ 34'\ \text{O.}}$

Ende August — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{+\ 7^\circ.55}{35.07\ ‰}$ — $\frac{+\ 9^\circ.68}{34.41\ ‰}$.

Verbreitungsbezirk.

Lat. Mittelmeer — $\frac{73^\circ\ 15'\ \text{N.}}{18^\circ\ 34'\ \text{O.}}$

Long. Irmingersee — $\begin{cases} \frac{20^\circ\ 32'\ \text{O.}}{70^\circ\ 23'\ \text{N.}}\ \text{(Eismeer).} \\ \text{c. } 12^\circ\ \text{O. (Skagerak).} \\ \text{c. } 5^\circ\ \text{O. (Mittelmeer).} \end{cases}$

Ceratium furca Ehrbg.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{70^\circ\ 23'\ \text{N.}}{20^\circ\ 32'\ \text{O.}} — \frac{75^\circ\ 50'\ \text{N.}}{15^\circ\ 32'\ \text{O.}}$; Long. $\frac{15^\circ\ \text{O.}}{75^\circ\ 35'\ \text{N.}} — \frac{20^\circ\ 32'\ \text{O.}}{70^\circ\ 23'\ \text{N.}}$

Ende August — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{+\ 5^\circ.20}{34.93\ ‰} — \frac{+\ 9^\circ.68}{34.41\ ‰}$; Salzgehalt: $\frac{34.41\ ‰}{+\ 9^\circ.68} — \frac{35.17\ ‰}{+\ 7^\circ.55}$.

Verbreitungsbezirk.

Lat. Mittelmeer — $\frac{79^\circ\ 32'\ \text{N.}}{9^\circ\ 25'\ \text{W.}}$

Long. New Foundland — $\begin{cases} \frac{20^\circ\ 32'\ \text{O.}}{70^\circ\ 23'\ \text{N.}}\ \text{(Eismeer).} \\ \text{c. } 12^\circ\ \text{O. (Skagerak).} \\ \text{c. } 14^\circ\ \text{O. (Mittelmeer).} \end{cases}$

Ceratium fusus Ehrbg.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{70^\circ\ 23'\ \text{N.}}{20^\circ\ 32'\ \text{O.}} — \frac{79^\circ\ 45'\ \text{N.}}{11^\circ\ \text{O.}}$
Long.

Mitte Juni — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{+\ 5^\circ.20}{34.93\ ‰} — \frac{+\ 9^\circ.40}{34.92\ ‰}$; Salzgehalt: $\frac{34.41\ ‰}{+\ 9^\circ.37} — \frac{35.17\ ‰}{+\ 7^\circ.55}$.

Verbreitungsbezirk.

Lat. Mittelmeer — $\frac{\text{c. } 79^\circ\ 45'\ \text{N.}}{\text{c. } 11^\circ\ \text{O.}}$

Long. New Foundland — $\begin{cases} \frac{20^\circ\ 32'\ \text{O.}}{70^\circ\ 23'\ \text{N.}}\ \text{(Eismeer).} \\ \text{c. } 20^\circ\ \text{O. (Baltisches Meer).} \\ \text{c. } 14^\circ\ \text{O. (Mittelmeer).} \end{cases}$

Diplopsalis lenticula Bergh.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{71^\circ\ 50'\ \text{N.}}{19^\circ\ 2'\ \text{O.}} — \frac{80^\circ\ 31'\ \text{N.}}{18^\circ\ 50'\ \text{O.}}$; Long. $\frac{15^\circ\ 25'\ \text{O.}}{75^\circ\ 50'\ \text{N.}} — \frac{19^\circ\ 2'\ \text{O.}}{71^\circ\ 50'\ \text{N.}}$

Lat. Mittelmeer — $\frac{80^\circ\ 31'\ \text{N.}}{18^\circ\ 50'\ \text{O.}}$

Long. $\frac{11^\circ\ 5'\ \text{W.}}{57^\circ\ 30'\ \text{N.}}$ — $\begin{cases} \frac{19^\circ\ 2'\ \text{O.}}{71^\circ\ 50'\ \text{N.}}\ \text{(Eismeer).} \\ 12^\circ\ \text{O. (Baltisches Meer).} \\ 14^\circ\ \text{O. (Mittelmeer).} \end{cases}$

Dinophysis acuta Ehrbg.

Fundorte und -zeiten im N. Nordmeére.

Lat. $\frac{71^\circ\ 50'\ \text{N.}}{19^\circ\ 2'\ \text{O.}}$ — $\frac{75^\circ\ 30'\ \text{N.}}{15^\circ\ 20'\ \text{O.}}$; Anfang September.

Verbreitungsbezirk.

Lat. Mittelmeer — $\frac{75^\circ\ 30'\ \text{N.}}{15^\circ\ 20'\ \text{O.}}$

Long. 74° 32′ W. — $\begin{cases} \frac{19^\circ\ 2'\ \text{O.}}{71^\circ\ 50'\ \text{N.}}\ \text{(Eismeer).} \\ \text{c. } 25^\circ\ \text{O. (Baltisches Meer).} \\ \text{c. } 14^\circ\ \text{O. (Mittelmeer).} \end{cases}$

Dinophysis Michaëlis Ehrbg.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{71^\circ\ 50'\ \text{N.}}{19^\circ\ 2'\ \text{O.}}$ — $\frac{80^\circ\ 31'\ \text{N.}}{18^\circ\ 50'\ \text{O.}}$; Long. $\frac{9^\circ\ 25'\ \text{W.}}{79^\circ\ 32'\ \text{N.}}$ — $\frac{19^\circ\ 2'\ \text{O.}}{71^\circ\ 50'\ \text{N.}}$

Anfang August — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{+\ 2°.42}{33.93\ ‰}$ — $\frac{+\ 4°.2}{33.71\ ‰}$.

Verbreitungsbezirk.

Lat. Mittelmeer — $\frac{80^\circ\ 31'\ \text{N.}}{18^\circ\ 50'\ \text{O.}}$

Long. $\left\{ \begin{array}{l} \text{c. } 5^\circ\ \text{W. (Concarneau?)} \\ \frac{9^\circ\ 25'\ \text{O.}}{79^\circ\ 32'\ \text{N.}} \end{array} \right\}$ — $\begin{cases} \frac{19^\circ\ 2'\ \text{O.}}{71^\circ\ 50'\ \text{N.}}\ \text{(Eismeer).} \\ \text{Baltisches Meer.} \\ 14^\circ\ \text{O. (Mittelmeer).} \end{cases}$

Dinophysis sphærica Stein (veris.).

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{80° 31' \text{ N.}}{18° 50' \text{ O.}}$; den 25. August 1898.
Long.

Physikalische Verhältnisse.

Temperatur: $\frac{+ 2°.42}{33.93\ ‰}$.
Salzgehalt:

Verbreitungsbezirk.

Lat. Mittelmeer — $\frac{80° 31' \text{ N.}}{18° 50' \text{ O.}}$

Long. »Atlanten» — $\begin{cases} \frac{18° 50' \text{ O.}}{80° 31' \text{ N.}} \text{ (Eismeer).} \\ \text{c. } 12° \text{ O. (Skagerak).} \\ \text{Mittelmeer.} \end{cases}$

Gonyaulax spinifera Cl. et Lachm.

Fundorte und -zeiten im N. Nordmeere.

Long. $\frac{71° 50' \text{ N.}}{19° 2' \text{ O.}}$; den 5. September 1898.
Lat.

Verbreitungsbezirk.

Lat. Mittelmeer — $\frac{71° 50' \text{ N.}}{19° 2' \text{ O.}}$

Long. c. 5° O. (Bergen) — $\begin{cases} \frac{19° 2' \text{ O.}}{71° 50' \text{ N.}} \text{ (Eismeer).} \\ \text{c. } 12° \text{ O. (Skagerak).} \\ \text{c. } 14° \text{ O. (Mittelmeer).} \end{cases}$

Oithona similis Claus.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{70° 45' \text{ N.}}{20° 3' \text{ O.}} — \frac{81° 14' \text{ N.}}{22° 50' \text{ O.}}$; Long. $\frac{3° 5' \text{ W.}}{77° 52' \text{ N.}} — \frac{34° 30' \text{ O.}}{78° 38' \text{ N.}}$

Juni — Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{- 0°.90}{32.03\ ‰} — \frac{+ 9°.68}{34.41\ ‰}$; Salzgehalt: $\frac{32.03\ ‰}{- 0°.90} — \frac{35.15\ ‰}{+ 6°.26}$.

Verbreitungsbezirk.

Lat. Mittelmeer — $\begin{cases} \frac{75^\circ\ 32'\ \text{N.}}{74^\circ\ 32'\ \text{O.}} \\ \frac{79^\circ\ 32'\ \text{N.}}{9^\circ\ 25'\ \text{W.}} \\ \frac{81^\circ\ 14'\ \text{N.}}{22^\circ\ 50'\ \text{O.}} \end{cases}$

Long. $\frac{74^\circ\ 32'\ \text{W.}}{75^\circ\ 32'\ \text{N.}}$ — $\begin{cases} \frac{34^\circ\ 30'\ \text{O.}}{78^\circ\ 38'\ \text{N.}} \text{ (Eismeer).} \\ \text{c. } 20^\circ \text{ O. (Baltisches Meer).} \\ \text{c. } 14^\circ \text{ O. (Mittelmeer).} \end{cases}$

Acartia longiremis Lillj.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{71^\circ\ 23'\ \text{N.}}{15^\circ\ 30'\ \text{O.}}$ — $\frac{79^\circ\ 45'\ \text{N.}}{\text{c. } 11^\circ\ \text{O.}}$; Ende Juli; Anfang September.

Physikalische Verhältnisse.

Temperatur: + 8°.

Verbreitungsbezirk.

Lat. $\frac{53^\circ\ 49'\ \text{N.}}{5^\circ\ 27'\ \text{O.}}$ — $\begin{cases} 62^\circ \text{ (W. Grönl. Meer).} \\ \frac{79^\circ\ 45'\ \text{N.}}{\text{c. } 11^\circ\ \text{O.}} \end{cases}$

Long. $\begin{cases} \text{W. Grönl. Meer} \\ \text{»W. von Irland»} \end{cases}$ — $\begin{cases} \frac{\text{c. } 20^\circ\ \text{O.}}{71^\circ\ \text{N.}} \\ \text{c. } 20^\circ \text{ O. (Baltisches Meer).} \end{cases}$

Temora longicornis O. F. Müller.

Fundorte und -zeiten im N. Nordmeere.

c. 71° N. (Nordküste Norwegens. Den 15. September 1896.

Verbreitungsbezirk.

Lat. 50° N. (Engl. Kanal) — c. 71° N. (Nordküste Norwegens).

Long. c. 11° W. (Westküste Irlands) — $\begin{cases} \text{c. } 20^\circ \text{ O. (Nordküste Norwegens).} \\ \text{c. } 20^\circ \text{ O. (Baltisches Meer).} \end{cases}$

Metridia hibernica Brady et Rob.

Fundorte und -zeiten im N. Nordmeere.

c. 71° N. (Nordküste Norwegens). Den 15. September 1896.

Verbreitungsbezirk.

Lat. $\frac{51°22'\ N.}{12°\ 25'\ W.}$ — c. 71° N. (Nordküste Norwegens).

Long. $\frac{15°\ 24'\ W.}{53°\ 24'\ N.}$ — $\begin{cases} 18° — 20°\ O. \text{ (Nordküste Norwegens).} \\ c.\ 12°\ O. \text{ (Skagerak).} \end{cases}$

Evadne Nordmanni Lovén.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{70°\ 23'\ N.}{20°\ 32'\ O.}$ — $\frac{72°\ 5'\ N.}{19°\ 16'\ O.}$; Ende August und Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{+\ 9°}{34.94\ ‰}$ — $\frac{+\ 9°.37}{34.41\ ‰}$.

Verbreitungsbezirk.

Lat. c. 54° (S.O. Nordsee) — $\begin{cases} \frac{72°\ 5'\ N.}{19°\ 16'\ O.} \text{ (Eismeer).} \\ 65°\ 37'\ N. \text{ (Baltisches Meer).} \end{cases}$

Long. $\frac{11°\ 5'\ W.}{57°\ 30'\ N.}$ — $\begin{cases} \frac{20°\ 32'\ O.}{70°\ 23'\ N.} \text{ (Eismeer).} \\ c.\ 25°\ O. \text{ (Baltisches Meer).} \end{cases}$

Podon polyphemoides Leuck.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{70°\ 23'\ N.}{20°\ 32'\ O.}$; 6. September 1896.

Physikalische Verhältnisse.

Temperatur: $\frac{+\ 9°.37}{34.41\ ‰}$.

Verbreitungsbezirk.

Lat. Mittelmeer — $\begin{cases} \frac{70°\ 23'\ N.}{20°\ 32'\ O.} \text{ (Eismeer).} \\ 65°\ 37'\ N. \text{ (Baltisches Meer).} \end{cases}$

5. W. oder S.W. Europäisches Küstenplankton.

Ceratium tripus O. F. Müll. var. bucephala Cleve.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{71° 23' \text{ N.}}{15° 30' \text{ O.}} — \frac{75° 42' \text{ N.}}{15° \text{ O.}}$; Long. $\frac{15° \text{ O.}}{75° 42' \text{ N.}} — \frac{18° 48' \text{ O.}}{72° 29' \text{ N.}}$

Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{+ 8°.87}{35.04\ ‰}$.

Verbreitungsbezirk.

Lat. c. 48° N. (Bretagne) — $\frac{75° 42' \text{ N.}}{15° \text{ O.}}$

Long. 0° 59' W. (Färökanal) — $\begin{cases} \frac{15° 30' \text{ O.}}{71° 23' \text{ N.}} \text{ (Eismeer).} \\ \text{c. } 12° \text{ O. (Skagerak).} \end{cases}$

Anomalocera Patersoni Templ.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{70° 23' \text{ N.}}{20° 32' \text{ O.}} — \frac{72° 43' \text{ N.}}{18° 43' \text{ O.}}$; Long. $\frac{15° 38' \text{ O.}}{71° 03' \text{ N.}} — \frac{20° 32' \text{ O.}}{70° 23' \text{ N.}}$

Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{+ 8°.5}{35.08\ ‰} — \frac{+ 9°.40}{34.92\ ‰}$; Salzgehalt: $\frac{34.41\ ‰}{+ 9°.37} — \frac{35.08\ ‰}{+ 8°.5}$.

Verbreitungsbezirk.

Lat. Mittelmeer — $\frac{72° 43' \text{ N.}}{18° 43' \text{ O.}}$

Long. $\frac{14° \text{ W.}}{58° — 60° \text{ N.}} — \begin{cases} \frac{20° 32' \text{ O.}}{70° 23' \text{ N.}} \text{ (Eismeer).} \\ \text{c. } 12° \text{ O. (Skagerak).} \\ \text{c. } 14° \text{ O. (Mittelmeer).} \end{cases}$

Acartia Clausi Giesbr.

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{70° 23' \text{ N.}}{20° 32' \text{ O.}} — \frac{73° 58' \text{ N.}}{19° 3' \text{ O.}}$; Long. $\frac{15° 30' \text{ O.}}{71° 23' \text{ N.}} — \frac{21° 46' \text{ O.}}{72° 10' \text{ N.}}$

Anfang Juni; Anfang September.

Physikalische Verhältnisse.

Temperatur: $\frac{+ 5°.08}{34.67\ ‰} — \frac{+ 9°.40}{34.92\ ‰}$; Salzgehalt: $\frac{34.41\ ‰}{+ 9°.37} — \frac{35.25\ ‰}{+ 5°.53}$.

Verbreitungsbezirk.

Lat. Mittelmeer — $\frac{73° 58' \text{ N.}}{19° 3' \text{ O.}}$

Long. c. 10° W. (Küste Irlands und Portugals) — $\begin{cases} \frac{21° 46' \text{ O.}}{72° 10' \text{ N.}} \text{ (Eismeer).} \\ \text{c. } 12° \text{ O. (Skagerak).} \\ \text{c. } 14° \text{ O. (Mittelmeer).} \end{cases}$

Conchoecia elegans G. O. Sars.[1]

Fundorte und -zeiten im N. Nordmeere.

Lat. $\frac{76° 36' \text{ N.}}{12° 13' \text{ O.}} — \frac{79° 58' \text{ N.}}{9° 35' \text{ O.}}$; Long. $\frac{2° 58' \text{ W.}}{78° 13' \text{ N.}} — \frac{12° 13' \text{ O.}}{76° 36' \text{ N.}}$

Ende Juli — Ende August.

Physikalische Verhältnisse.

Da alle Individuen in offenen Vertikalfängen von 0—2,600 Meter gefangen sind, kann über diese Verhältnisse nichts mit Bestimmtheit angegeben werden.

Verbreitungsbezirk.

Lat. $\frac{37° 45' \text{ N.}}{13° 38' \text{ W.}} — \frac{79° 58' \text{ N.}}{9° 35' \text{ O.}}$

Long. $\begin{cases} \frac{13° 38' \text{ W.}}{37° 45' \text{ N.}} \\ \frac{2° 58' \text{ W.}}{78° 13' \text{ N.}} \end{cases} — \begin{cases} \text{c. } 11° \text{ O. (Skagerak).} \\ \frac{12° 13' \text{ O.}}{76° 36' \text{ N.}} \text{ (Eismeer).} \end{cases}$

Bemerkung. Da in den *Oberflächenfängen* von dieser sowie von der folgenden Art kein Exemplar angetroffen worden ist, so kommt es wahrscheinlich vor, dass diese Conchoecien im Eismeere, gleichwie in niedrigeren Breiten, mehr oder weniger tief unter der Oberfläche leben. *Welche* diese Tiefe ist, lässt sich aber in

[1] Es sind diese Conchoecien vom Kand. Joh. Gunnar Anderszon, welcher die Planktonfänge während der Antarctic Expedition besorgte, bestimmt worden.

den fraglichen Fällen nicht näher ermitteln, da es um offene Vertikalfänge von 0 bis zu resp. 400, 500 und 2,600 Metern handelt. Bei der noch sehr ungenügenden Kenntniss der *horizontalen* Verbreitung dieser Arten muss die Erklärung dieser Verhältnisse bis auf weiteres verschoben werden und zwar also auch ihre Einreihung unter dem Plankton südlicher Herkunft als provisorisch gelten.

Conchoecia borealis G. O. Sars.[1]

Fundorte und -zeiten im N. Nordmeere.

= derjenigen der vorigen Art.

Physikalische Verhältnisse.

Vergl. oben.

Verbreitungsbezirk.

Lat. c. 58° N. (Skagerak) — $\frac{79°\ 58'\ \text{N.}}{9°\ 35'\ \text{O.}}$

Long. $\left\{\begin{matrix}\frac{5°\ 29'\ \text{W.}}{63°\ 22'\ \text{N.}} \\ \frac{2°\ 58'\ \text{W.}}{78°\ 13'\ \text{N.}}\end{matrix}\right\}$ — $\frac{\text{Skagerak.}}{\begin{matrix}12°\ 13'\ \text{O.} \\ 76°\ 36'\ \text{N.}\end{matrix}}$

Heterochæta angulata n. sp.

Männchen.

Diagn. 5. Fuss asymmetrisch.

Re 3 des 3. Fusses breit, oval, mit verkürzter St (Taf. 20, Fig. 22 bei Giesbrecht).

B 1 des hinteren Maxillipeden in der Mitte des Innenrandes mit auffalland dicker und langer Borste, wenn gestreckt über das Ende des B 2 hinausreichend. Rostralpapille ohne Spitze.

Sp von L 4 des vorderen Maxillipeden über halb so lang wie die Sa.

B 2 des rechten 5. Fusses mit langem, behaarten Fortsatz am Innenrande. B 2 des linken, mit stark vorspringendem, lang behaarten Höcker am Innenrande. (Hastenus = *H. Clausi* Giesbrecht). Aber:

1) Re 3 des rechten 5. Fusses etwa so lang wie Re 2 und Re 1 zusammengenommen (bei *H. Clausi* ist jenes Glied länger als diese (Fig. 4, Seite 39).
2) der behaarte Vorsprung des B 2 des linken 5. Fusses (Fig. 5, Seite 39) ist länglich, fast die ganze Länge des Gliedes aufnehmend;
3) Re 3 des linken 5. Fusses ist kürzer als Re 2, gerundet rhomboidisch, am Ende in der Aussenecke mit einem kurzen Se, an der Innenecke mit einem von jenem weit getrennten, *durch Segmentirung* vom Gliede abgegrenzten, proximalwärts mässig verdickten, sodann knieförmig gekrümmten Si.

[1] Siehe die Note Seite 37.

4) Vorderfühler: 8. und 9. Glied undeutlicher als die nächst liegenden getrennt; die Glieder 14—18 etwas länger als 19—24. Es reichen diese Fühler, wenn nach hinten gelegt, etwa bis zu den Enden der Furca (oder ein wenig über diese hinaus).

Fig. 4.

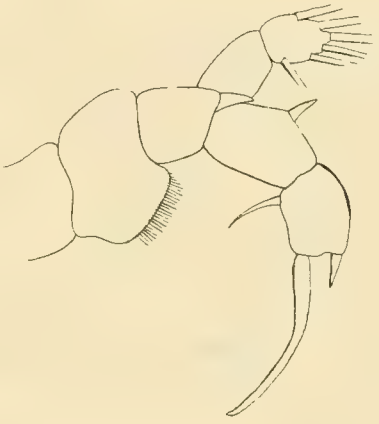

Fig. 5.

5) Die hinteren Maxillipeden: das Börstchen in der Mitte des Innenrandes von B 1 und der Stachel am Ende desselben Gliedes wie bei *H. papilligera* (vergl. Taf. 20, Fig. 17 bei Giesbrecht).

Fundorte und -zeiten im N. Nordmeere.

Nahe bei { Lat. 77° 52′ N. / Long. 3° 5′ W. } 29. Juli 1898.

Bemerkung. Von der Einreihung dieser Form in die fragliche Planktonkategorie gilt das soeben über die Conchoecien gesagte.

FANGTABELLEN.

Die Virgo-

Juni und

Ort des Fanges	Lat. 71° 15′ N. Long. 20° 29′ O.	Lat. 73° 20′ N. Long. 19° 20° O.	W. von Beeren-Island.	Im Sunde zwischen . den »Nor-
Zeit des Fanges	Juni 14. (1 Nachm.)	Juni 14. (9,30 Nachm.)	Juni 15. (11 Vorm.)	Juni 21.
Tiefe des Fanges in Met.	0.	0.	0.	—
Salzgehalt des Wassers ‰	—	—	34.84 ‰.	—
Temperatur des Wassers ° *Cels.*	—	—	+ 0°.86.	—
Globigerina bulloides	—	rr	—	—
Peridinium divergens v. depressa	—	—	—	—
Ceratium tripus	c	r	—	—
» » v. arctica	c	+	—	r
» fusus	—	—	—	—
Tintinnus denticulatus	—	—	—	—
Ptychocylis obtusa	—	—	—	rr
Mertensia ovum (?)	—	—	—	—
Chætognath, jun.	—	—	—	—
Larven von Anneliden	—	—	—	—
Mysis von Macruren-Dekapoden	—	—	rr	—
Zoea von Brachyuren-Dekapoden	—	—	rr	—
Nauplii von Cirripeden	—	—	c	—
Metanauplii von »	—	—	+	—
Cyprislarven » »	—	—	c	—
Calanus finmarchicus	+ (♀ ad. et jun.)	—	+ (♀ ad. et jun.)	—
Pseudocalanus elongatus	—	—	rr (♀ ad.)	—
Acartia longiremis	—	—	—	—
Oithona similis	—	rr	—	—
Microsetella atlantica	—	—	—	—
Nauplii und Cyclopen von Copepoden	—	—	—	cc
Euthemisto libellula	—	rr	—	—
Junge von Mollusken	—	—	—	—
Limacina helicina	—	—	—	—
Fritillaria borealis	—	—	—	r

Expedition.

Juli 1896.

Smeerenburg.	Danes Gat.	Magdalene Bay.	Danes Gat.	Danes Gat.	Dancs Gat.	Danes Gat.	Danes Gat.	Danes Gat.
Juni 27.	Juli 2.	Juli 6.	Juli 9.	Juli 14.	Juli 18.	Juli 21.	Juli 25.	Juli 29.
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
+	—	r	—	—	r	—	r	—
—	—	—	—	—	—	—	—	—
—	+	r	r	r	+	c	+	+
—	—	—	—	r	—	—	—	
—	r	—	—	—	r	—	r	rr (todt)
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	r
—	—	—	—	—	—	—	r (jun.)	r (jun.)
—	—	—	—	+	—	+	+	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
r (ad. et jun.)	c (♀ ad. et jun.)	r (♀ ad.)	r	c (ad. et jun.)	+ (ad. et jun.)	—	+	+
+ (♀ ad.)	r (♀ ad.)	r (♀)	r (♀)	+ (♀); rr (♂ jun.)	—	—	+ (♀) ♂ jun.)	—
—	—	r	—	—	r	—	—	—
c	c	r (jun.)	+	c	c	c	c	cc
—	—	—	—	—	r	r	r	—
c	c	r	+	c	c	c	c	cc
+	+	—	—	—	—	—	—	—
c	—	—	—	—	—	—	—	c
—	+	c	—	—	+	+	—	rr
+	r	—	—	r	—	—	—	—

Die Virgo-

August

Ort des Fanges	Danes Gat.	Amsterdam-Insel.	Danes Gat.	Lat. 79° 32' N Long. 9° 32' O.
Zeit des Fanges	August 9.	August 12.	August 13.	August 20. (c. 4.45 Nachm.
Tiefe des Fanges in Met.	0.	0.	0.	0
Salzgehalt des Wassers ‰	—	—	—	33.71 ‰
Temperatur des Wassers ° *Cels.*	—	—	—	4.2
Plagiacantha arachnoides	—	—	—	—
Litholophus arcticus	—	—	—	r
Peridinium divergens v. depressa	—	r	+	+
» ovatum	—	r	—	r
» pellucidum	—	—	—	—
Ceratium tripus v. arctica	—	c	+	+
Dinophysis Michaëlis	—	—	—	r
Tintinnus denticulatus	—	—	rr (todt)	r
Ptychocylis acuta	—	—	—	r
Codonium princeps	—	rr	—	—
Mertensia ovum (veris.)	r (beschädigt)	r	—	—
Pleurobrachia pileus	—	r	+	—
Chætognath, jun.	—	—	r	—
Calanus finmarchicus	+ (♀ ad. et jun.)	+ (♀ ad. et jun.)	+	+ (♀ ad.)
Pseudocalanus elongatus	—	—	—	—
Oithona similis	+	c	c	+
Microsetella atlantica	—	—	—	—
Nauplii und Cyclopen von Copepoden	c	cc	cc	+
Euthemisto libellula	—	—	—	—
Megalopa von Brachyuren-Dekapoden	—	—	—	—
Junge von Mollusken	—	c	—	+
Larven von Opistobranchiaten	—	—	—	r
Limacina helicina	c	+	+	—
Fritillaria borealis	—	+	c	+

Expedition.

1896.

Lat 79° 20′ N. Long. 7° 45′ O.	Lat. 79° 10′ N. Long. 6° 20′ O.	Lat. 79° N. Long. 4° 45′ O.	Lat. 78° 48′ N. Long. 3° 20′ O.	Lat. 78° 50′ N. Long. 2° 45′ O.	Lat. 78° 22′ N. Long. 5° 12′ O.	Lat. 78° 1′ N. Long. 7° 2′ O.	Lat. 77° 33′ N. Long. 9° 29′ O.	Lat. 77° 19′ N. Long. 10° 43′ O.
August 20. (c. 8 Nachm.)	August 21. (c. Mittern.)	August 21. (c. 4.50 Vorm.)	August 21. (c. 9.15 Vorm.)	August 21. (c. 12 Mitt.)	August 21. (7 Nachm.)	August 21. (10 Nachm.)	August 22. (2 Vorm.)	August 22. (4 Vorm.)
0.	0.	0.	0.	0.	0.	0.	0.	0.
33.17 ‰.	34.57 ‰.	34.89 ‰.	34.57 ‰.	34.77 ‰.	35.00 ‰.	34.86 ‰.	34.52 ‰.	34.00 ‰.
3°.03.	4°.82.	4°.88.	4°.10.	4°.50.	5°.70.	5°.60.	5°.45.	5°.97.
—	rr	rr	—	—	—	—	—	—
—	+	+	—	r	—	—	—	—
+	—	r	r	—	—	—	—	—
—	—	—	—	—	—	—	—	—
r	r	rr	—	—	—	—	—	—
c	+	+	r	r	rr	—	rr (leer)	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
+ (♀ ad.)	+	—	—	—	—	{rr (leere Häut-chen)}	{+ (die meisten = leere Häut-chen].}	{+ (die meisten = leere Häut-chen).}
—	r (♂ jun.)	—	—	—	—	—	—	—
c	+	+	r	+	—	rr	—	—
r	—	—	—	—	—	—	—	—
{c (Nauplii) + (Cyclopen)}	c	+	r	+	—	—	—	—
—	—	rr	—	—	rr	—	—	—
—	—	—	—	—	—	—	—	—
+	—	r	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
+	+	+	r	+	—	—	—	—

Die Virgo-

August

Ort des Fanges	Lat. 77° 5′ N. Long. 11° 56′ O.	Lat. 76° 37′ N. Long. 14° 24′ O.	Lat. 76° 7′ N. Long. 15° 34′ O.	Lat. 75° 33′ N. Long. 16° 23′ O.	Lat. 75 1′ N. Long. 17° 10′ O.
Zeit des Fanges	August 22. (6 Vorm.)	August 22. (10 Vorm.)	August 22. (2 Nachm.)	August 22. (6 Nachm.)	August 22. (9.45 Nachm.)
Tiefe des Fanges, in Met.	0.	0.	0.	0.	0.
Salzgehalt des Wassers ‰	33.54 ‰.	32.82 ‰.	33.21 ‰.	35.00 ‰.	34.60 ‰.
Temperatur des Wassers Cels.	4°.65.	2°.12.	4°.45.	6°.07.	2°.90.
Peridinium divergens v. depressa	—	—	—	—	—
» pellucidum	—	—	—	—	—
Ceratium tripus	—	—	—	—	—
» » v. arctica	—	—	—	—	—
» » v. macroceros	—	—	—	—	—
» furca	—	—	—	—	—
» fusus	—	—	—	—	—
Tintinnus denticulatus	—	—	—	—	—
Ptychocylis acuta	—	—	—	—	—
Chætognath, jun.	—	—	—	—	—
Cypris von Cirripeden	—	—	—	—	—
Calanus finmarchicus	+ (leere Häutchen)	+ (leere Häutchen)	+ (leere Häutchen)	+ (meist leere Häutchen)	r
Oithona similis	—	—	—	—	—
Microsetella atlantica	—	—	—	—	r
Nauplii und Cyclopen von Copepoden	—	—	—	—	—
Evadne Nordmanni	—	—	—	—	—
Megalopa von Brachyuren-Dekapoden	—	—	—	—	—
Junge von Mollusken	—	—	—	—	—
Limacina helicina	—	—	—	—	—
» balea	—	—	—	—	—
Oikopleura Vanhöffeni (veris.)	—	—	—	—	—
Fritillaria borealis	—	—	—	—	—

Expedition.

1896.

Lat. 74° 57′ N. Long. 17° 15′ O.	Lat. 74° 40′ N. Long. 17° 30′ O.	Lat. 74° 18′ N. Long. 17° 50′ O.	Lat. 73° 55′ N. Long. 18° 10′ O.	Lat. 73° 15′ N. Long. 18° 34′ O.	Lat. 72° 35′ N. Long. 18° 50′ O.	Lat. 72° 5′ N. Long. 19° 16′ O.	Lat. 71° 25′ N. Long. 19° 40′ O.	Lat. 70° 45′ N. Long. 20° 3′ O.
August 22.	August 23. (Nach Mittern.)	August 23. (1—2 Vorm.)	August 23.	August 23. (11 Vorm.)	August 23. (3 Nachm.)	August 33. (6 Nachm.)	August 23. (10 Nachm.)	August 24. (2 Vorm.)
0.	0.	0.	0.	0.	0.	0.	0.	0.
34.93 °/₀₀.	34.31 °/₀₀.	34.83 °/₀₀.	34.48 °/₀₀.	35.17 °/₀₀.	35.06 °/₀₀.	34.94 °/₀₀.	34.94 °/₀₀.	34.41 °/₀₀.
5°.20.	2°.0.	3°.7.	4°.4.	7°,55.	8°.06.	9°.0.	9°.0.	9°.68.
+	—	—	—	r (leer)	rr (leer)	r (leer)	—	—
r	—	—	-	—	—	—	—	—
—	—	—	—	r (leer)	r (leer)	+ (leer)	—	+
c	—	+	c	+ (leer)	+ (leer)	+ (leer)	—	rr
—	—	—	—	r (leer)	r (leer)	+ (leer)	—	+
rr	—	—	—	r (leer)	—	r (leer)	—	r
rr	—	—	—	r (leer)	—	r (leer)	—	—
+	—		—	—	—	—	—	rr (leer)
r	—	—	—	—	—	—	—	
—	—	r	—	—	—	—	—	
—	—	—	—	—	—	—	—	r
+ (♀ jun.)	c (♀ ad. et jun.)	+	+ (♀ ad. et jun.)	—	—	—	+ (♀ ad. et jun., beschädigt)	r
c	+	—	c	—	rr	r	r	—
r (♀)	+	—	—	—	—	r	r	r
c	—	+	c	—	—	—	—	—
—	—	—	—	—	—	r (beschädigt)	—	—
—	rr	—	—	—	—			
c	—	cc	+	—	—	—	—	—
—	rr	rr	—	—	—	—	—	-
—	—	—	—	—	—	—	rr	r
—	—	+	—	—	—	—	—	—
+	—	c	c	—	—	—	—	—

Die De Geer'sche

Juli und Sep-

Ort des Fanges	Sassenbay.	Adventbay.	Adventbay.	W.S.W. von Belsound.
Zeit des Fanges	Juli 4.	Juli 16.	Juli 31.	September 7. (5 Nachm.)
Tiefe des Fanges in Met.	0.	0.	0.	0.
Salzgehalt des Wassers ‰	—	—	—	—
Temperatur des Wassers ° *Cels.*	—	—	—	—
Globigerina bulloides	—	—	—	—
Acanthostaurus pallidus	—	—	—	—
Litholophus arcticus	—	—	—	—
Peridinium divergens	—	—	—	—
» » v. depressa	—	—	+	—
» ovatum	—	—	—	—
» pellucidum	—	—	—	—
Ceratium tripus	—	—	—	—
» » v. arctica	—	—	+	—
» » v. macroceros	—	—	—	—
» » v. bucephalus	—	—	—	—
» furca	—	—	—	—
» fusus	—	—	—	—
Dinophysis acuta	—	—	—	—
» Michaëlis	—	—	—	—
Tintinnus denticulatus	—	—	r	—
» (Cyttarocylis) edentatus	—	—	—	—
» secatus	—	—	—	—
» urnula v. digitate = Ptychocylis arctica Br.	—	—	—	—
» norvegicus	—	—	—	—
Beroe cucumis	—	rr	—	rr (beschädigt)
Sagitta arctica	—	—	—	—
Chætognath, jun.	—	—	—	rr
Nauplii von Cirripeden	—	—	—	—
Calanus finmarchicus	+ (♀, meist jun.)	—	+	cc
» hyperboreus	rr (♀)	rr (♀)	—	—
Pseudocalanus elongatus	rr (♀)	—	rr (♂ jun.)	r (♂ jun.)
Euchæta norvegica	—	—	—	—
Metridia hibernica	—	—	—	—
Anomalocera Patersoni	—	—	—	—
Acartia longiremis	—	—	+	—
» Clausi	—	—	—	—

Expedition.

tember 1896.

Bellsound.	Lat. 75° 42′ N. Long. 15° 0′ O.	Lat. 75° 35′ N. Long. 15° 0′ O.	Lat. 75° 30′ N. Long. 15° 20′ O.	Lat. 71° 23′ N. Long. 15° 30′ O.	Lat. 71° 13′ N. Long 15° 38′ O.	Lat. 71° 03′ N. Long. 15° 38′ O.	5 Km. O. om Andenæs (Andön).
September 7. (7 Nachm.)	September. 9. (9 Vorm.)	September 9. (11.30 Vorm.)	September 9. (2 Nachm.)	September 12. (12 Mitt.)	September 12. (4 Nachm.)	September 12. (9 Nachm.)	September 15. (9 Nachm.)
0.	0.	0.	0.	0.	0.	0.	0.
—	—	—	—	—	—	38.08 ‰	—
—	—	—	—	+ 8°.	+ 8°.5.	+ 8°.5.	—
—	—	—	—	+	—	—	—
—	—	—	—	r	—	—	—
—	r	+	r	—	—	—	—
—	—	r (jun.)	—	—	—	—	—
—	+	r	r	—	—	—	—
—	—	—	rr	—	—	—	—
—	—	r	rr	—	—	—	—
—	rr	—	—	+	—	—	+
—	+	+	+	r	—	—	—
—	rr	—	—	—	—	—	+
—	rr	r	—	r	—	—	cc
—	r	r	r	—	—	—	+
—	r	—	r	r	—	—	c
—	—	—	rr	—	—	—	—
—	—	rr	—	—	—	—	—
—	+	—	+	+	—	—	+ (leer)
—	r	+	—	—	—	—	—
—	+	—	r	—	—	—	—
—	—	rr	—	—	—	—	—
—	—	rr	rr	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	r	—
rr	—	rr	—	—	—	—	+
—	—	—	—	—	—	—	—
+	+	—	—	+	c	cc	r
rr	—	—	—	—	—	—	c
r	r	—	—	—	—	r	—
—	—	—	—	—	—	+	r
—	—	—	—	—	—	—	
—	—	—	—	—	—	r (♂)	r
—	—	—	—	r	—	—	—
—	—	—	—	r	+	—	—

Ort des Fanges	Sassenbay.	Adventbay.	Adventbay.	W.S.W. von Belsound.
Zeit des Fanges	Juli 4.	Juli 16.	Juli 31.	September 7. (5 Nachm.)
Tiefe des Fanges in Met.	0.	0.	0.	0.
Salzgehalt des Wassers ‰	—	—	—	—
Temperatur des Wassers ° *Cels.*	—	—	—	—
Temora longicornis	—	—	—	—
Oithona similis	—	—	c	—
Microsetella atlantica	—	—	—	—
Nauplii und Cyclopen von Copepoden	—	—	+	—
Euthemisto libellula	c	+	r	—
Parathemisto oblivia	—	—	—	—
(Gammarus locusta)	—	rr	r	—
(Onesinus littoralis)	—	rr	—	—
(Apherusa glacialis)	rr (jun.)	—	—	—
Euphausia inermis	—	—	—	—
(Mysis oculata [relicta])	—	—	rr	—
Junge von Mollusken	—	—	—	—
Clione limacina	—	+	—	rr
Limacina helicina	—	+	—	—
» balea	—	—	—	—
Oikopleura Vanhöffeni	—	—	—	rr
Fritillaria borealis	—	—	rr	—

Belsound.	Lat. 75° 42′ N. Long. 15° 0′ O.	Lat. 75° 35′ N. Long. 15° 0′ O.	Lat. 75° 30′ N. Long. 15° 20′ O.	Lat. 71° 23′ N. Long. 15° 30′ O.	Lat. 71° 13′ N. Long. 15° 38′ O.	Lat. 71° 03′ N. Long. 15° 38′ O.	5 Km. O. om Andenæs (Andön).
September 7. (7 Nachm.)	September 9. (9 Vorm.)	September 9. (11.30 Vorm.)	September 9. (2 Nachm.)	September 12. (12 Mitt.)	September 12. (4 Nachm.)	September 12. (9 Nachm.)	September 15. (9 Nachm.)
0.	0.	0.	0.	0.	0.	0.	0.
—	—	—	—	—	—	35.08 ‰	—
—	—	—	—	+ 8°.	+ 8°.5.	+ 8°.5.	—
—	—	—	—	—	c	—	c
+	+	+	+	+	—	—	—
—	—	r	—	r	—	—	—
—	—	—	+	—	—	—	—
—	—	—	—	—	-	—	—
—	—	—	—	—	—	r	—
—	—	—	-	—	—	—	—
—	—	—	—	—	—		—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	rr	—
—	—	-	-	—	—	—	—
—	—	+	—	—	—	—	—
—	—	—	—	—	—	—	—
rr	—	—	—	—	—	—	—
—	r	—	—	—	—	—	—
—	—	—	—	—	—	—	—
+	r	—	—	—	—	—	—

Die Svensksund-

Mai und

Ort des Fanges	Lat. 69° 45′ N. Long. 17° 45′ O.	Lat. 70° 15′ N. Long. 17° 20′ O.	Lat. 73° 5′ N. Long. 16° 53′ O.	Lat. 79° 32′ N. Long. 10° 32′ O.
Zeit des Fanges	Mai 27. (10 Nachm.)	Mai 28. (1 Vorm.)	Mai 28. (12 Mittern.)	Juli 13. (8 Nachm.)
Tiefe des Fanges in Met.	0.	0.	0.	0.
Salzgehalt des Wassers ‰	—	—	—	—
Temperatur des Wassers ° *Cels.*	5°.3.	5°.52.	5°.35.	—
Globigerina bulloides	—	—	—	—
Litholophus arcticus	—	—	rr	—
Peridinium divergens v. depressa	rr	r	—	+
» pellucidum	—	—	—	r
Ceratium tripus v. arctica	—	rr	r	rr
Chætognath, jun. (veris. Krohnia hamata)	—	—	—	—
Calanus finmarchicus	cc (ad. et jun.)	cc	+	c
» hyperboreus	—	—	+	—
Pseudocalanus elongatus	—	—	—	—
Oithona similis	—	—	—	—
Nauplii und Cyclopen von Copepoden	—	—	—	—

Bemerkung. In den übrigen 44 Proben fehlte animalisches Plankton.

Expedition.

Juli 1897.

Lat. 77° 42′ N. Long. 10° 12′ O.	Lat. 77° 14′ N. Long. 11° 0′ O.	Lat. 76° 34′ N. Long. 11° 55′ O.	Lat. 76° 5′ N. Long. 12° 46′ O.	Lat. 75° 33′ N. Long. 13° 42′ O.	Lat. 75° 15′ N. Long. 13° 45′ O.	Lat. 74° 40′ N. Long. 14° 12′ O.	Lat. 74° 15′ N. Long. 14° 39′ O.
Juli 14. (8 Vorm.)	Juli 14. (11 Vorm.)	Juli 14. (5 Nachm.)	Juli 14. (8 Nachm.)	Juli 14. (11 Vorm.)	Juli 15. (2 Vorm.)	Juli 15. (5 Vorm.)	Juli 15. (8 Vorm.)
0.	0.	0.	0.	0.	0.	0.	0.
—	—	—	—	—	—	—	–
5°.4.	—	—	—	—	—	—	—
—	—	—	rr	—	—	—	—
—	—	rr	r	r	r	—	+
—	—	—	r	—	—	—	—
—	—	r	—	—	—	—	—
—	—	—	—	r	—	—	rr
—	r (jun.)	—	—	—	—	r (jun.)	—
r (jun.)	+ (jun.)	r (jun.)	+ (jun.)	c (jun.)	c (jun.)	+ (jun.)	c (jun.)
—	–	—	—	—	—	—	—
r (jun.)	—	—	—	—	r	—	—
r (jun.)	r	r	+	—	+	+	+
cc	—	—	—	c	—	—	—

Die Antarctic-

Juni

Ort des Fanges	Lat. 70° 54′ N. Long. 20° 43′ O.	Lat. 71° 10′ N. Long. 21° 31′ O.	Lat. 71° 35′ N. Long. 22° 47′ O.	Lat. 71° 42′ N. Long. 22° 35′ O.	Lat. 72° 10′ N. Long. 21° 46′ O.	Aat. 74° 53′ N. Long. 20° 17′ O.
Zeit des Fanges	Juni 9. (8 Nachm.)	Juni 10. (8 Vorm.)	Juni 10. (6 Vorm.)	Juni 10. (8 Nachm.)	Juni 11. (8 Vorm.)	Juni 20. (8 Nachm.)
Tiefe des Fanges in Met.	0.	0.	0—50 M. (Vertikalfang).	0.	0.	0.
Salzgehalt des Wassers ‰	34.83 ‰.	35.20 ‰.	—	35.15 ‰.	35.25 ‰.	34.76 ‰.
Temperatur des Wassers ° *Cels-*	+ 7°.15.	+ 6°.71.	—	+ 6°.40.	+ 5°.53.	+ 0°.16.
Globigerina bulloides	—	—	—	r	r	—
Collozoum inerme (veris.)	+	—	—	+	—	—
Peridinium divergens	—	—	—	r	—	—
» » v. depressa	r	—	—	r	—	—
Ceratium tripus	r	+	+ (die meisten todt)	—	—	—
» » v. arctica	+	+	+ (die meisten todt)	+	r	—
Tintinnus denticulatus (= gigantea BRANDT)	+	—	—	+	+	—
» » v. obtusa n. var.	—	—	—	—	—	—
Plutens von Spatangiden	—	—	—	—	r	—
Larven von Anneliden	—	—	—	—	—	—
Nauplius von Cirripeden	—	—	—	—	—	rr
Calanus finmarchicus	cc	r	+	c	—	rr (jun.)
» hyperboreus	r	—	—	r	—	—
Pseudocalanus elongatus	—	—	—	—	—	rr
Metridia longa	—	—	—	—	—	—
Acartia Clausi	r	r	—	—	r	—
Oithona similis	c	r	—	+	c	—
Nauplii und Cyclopen von Copepoden	—	—	—	—	—	—
Euthemisto libellula	—	—	—	—	c	—
Fritillaria borealis	—	—	—	—	—	—

Expedition.

1898.

Lat. 76° 27′ N. Long. 25° 55′ O.	Lat. 76° 45′ N. Long. 26° 0′ O.	?	Lat. 77° 25′ N. Long. 27° 30′ O.	Lat. 77° 25′ N. Long. 27° 30′ O.	Lat. 77° 15′ N. Long. 27° 10′ O.	Lat. 76° 34′ N. Long. 17° 24′ O.	Lat. 76° 46′ N. Long. 15° 22′ O.	Lat. 76° 46′ N. Long. 15° 22′ O.
Juni 21. (9 Nachm.)	Juni 22. (12 Mitt.)	Juni 22. (8 Nachm.)	Juni 23. (12 Mitt.)	Juni 23. (12 Mitt.)	Juni 23. (8 Nachm.)	Juni 25. (9 Nachm.)	Juni 26. (12 Mitt.)	Juni 26. (12 Mitt.)
0.	0.	0.	160 M. (über d. Boden.)	0.	0. (in Treibeis.)	0.	0.	210 M. (über d. Boden.)
33.68 ‰.	34.07 ‰	?	34.96 ‰.	32.97 ‰.	33.15 ‰.	33.80 ‰.	34.04 ‰.	35.06 ‰.
+ 0°.24.	+ 0°.8.	?	— 1°.71.	— 0°.35.	+ 0°.97.	+ 0°.6.	+ 0°.95.	+ 2°.83.
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—		—	—	—	—
rr	—	—	—	rr	—	—	—	—
r (todt)	rr (ohne Zähne)	—	—	—	—	—	—	—
r (todt)	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	rr	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
r (die meisten ♀ jung)	—	rr	—	—	r	rr (jun.)	—	r
—	—	—	—	—	—	—	—	—
—	—	—	r (♀, eiertragend)	—	—	—	—	—
—	—	—	r (♂ et ♂ jun.)	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	rr	—	—	—	r	—	—	—
rr	—	—	—	—	—	—	rr (die Cyclopen Cal. finmarchicus angehörig)	—
—	—		—	—	—	—	—	—

Die Antarctic-

Juli

Ort des Fanges	Recherche Bay.	Recherche Bay.	Recherche Bay.	Recherche Bay.
Zeit des Fanges	Juli 3. (10 Nachm.)	Juli 5. (6 Nachm.)	Juli 5. (8 Nachm.)	Juli 16.
Tiefe des Fanges in Met.	0.	0.	0.	0.
Salzgehalt des Wassers ‰	—	—	—	—
Temperatur des Wassers ° *Cels.*	—	—	—	—
Globigerina bulloides	—	—	—	—
Lithelophus arcticus	—	—	—	—
Peridinium divergens v. depressa	—	r	—	—
» pellucidum	—	r	—	—
» ovatum	—	rr	—	—
Ceratium tripus v. arctica		—	—	—
Tintinnus denticulatus		—	—	—
Sarsia brachygaster		rr (veris., beschädigt)	—	—
Pectyllis arctica	—	—	—	—
Hippocrene superciliaris	+	rr	r	+
Tiara conifera		rr (veris., beschädigt)	—	—
Pleurobrachia pileus	—	—	rr	r
Beroe cucumis	r	—	r	r
Sagitta arctica	—	+ (?, juniores)	—	—
Krohnia hamata	—	—	—	—
Trochophoræ von Anneliden	—	—	cc	—
Anneliden	r (jung)	r (jung)	cc (jung)	—
Cypris von Cirripeden	—	+	rr	—
Calanus finmarchicus	c (♀)	c (♀)	cc (♀)	+ (jung)
» hyperboreus			—	—
Pseudocalanus elongatus	—	r (♀)	—	—
Metridia longa	—	—	—	—
Euchæta norvegica	—	—	—	—
Oithona similis	—	r	—	—
Oncæa minuta	—	—	—	—
Nauplii und Cyclopen von Copepoden	—	—	—	—
Euthemisto libellula	rr (?, beschädigt)	—	—	—
Parathemisto oblivia	—	—	—	—
Euphausia inermis	—		—	—
Limacina helicina	+	-	r	—
Oikopleura Vanhöffeni	r (beschädigt)	r	r	r

Expedition.

1898.

Recherche Bay.	Recherche Bay.	Lat. 78° 5′ N. Long. 18° 55′ O. (= Münd. des Eisfjords.)	Lat. 78° 5′ N. Long. 18° 55′ O. (= Münd. des Eisfjords.)	Lat. 78° 5′ N. Long. 18° 55′ N. (= Münd. des Eisfjords).	Lat. 77° 39′ N. Long. 1° 18′ O.	Lat. 77° 39′ N. Long. 1° 18′ O.	Lat. 77° 39′ N. Long. 1° 18′ O.
Juli 16. (9 Nachm.)	Juli 16. (12 Mitt.)	Juli 24. (12 Mitt.)	Juli 24. (12 Mitt.)	Juli 24. (12 Mitt.)	Juli 26—27.	Juli 26—27.	Juli 26—27.
0.	0.	0.	405 M. (über d. Boden.)	In dem Trawl.	0.	0—100.	0—200.
—	—	32.22 ‰.	35.06 ‰.	—	33.56 ‰.	33.56—34.79 ‰.	33.56—34.93 ‰.
—	+ 4°.5.	+ 5°.07.	+ 3°.	—	3°.85.	3°.85—?	3°.85—+ 0°.58.
—	—	—	—	—	—	+	+
—	—	—	—	—	—	+	r
—	rr	—	—	—	—	—	—
—	—	—	—	—	—	+	—
—	—	—	—	—	—	—	—
—	rr	—	—	—	—	—	—
—	—	—	—	—	1 Ex. (todt)	+	—
—	—	—	—	—	—	—	—
—	—	—	—	c	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
r (?, juniores)	rr	—	—	—	—	—	—
—	—	—	—	—	—	r	+ (ad. et jun.)
c	—	—	—	—	—	—	—
c (jung)	r (jung)	—	—	—	—	—	—
—	r	—	—	—	—	—	—
+	cc (die meisten jun.)	rr	r (die meisten jun.)	—	—	c	cc
—	—	—	—	—	—	r	+
r	r	—	—	—	—	c	c
—	—	—	—	—	—	—	c (♀ et ♂, jun.)
—	—	—	—	—	—	—	r (♀)
—	—	—	—	—	—	c	c
—	—	—	—	—	—	r	+ (♂ et ♀)
—	cc	—	—	—	rr	cc	—
—	—	—	—	—	—	r	rr
—	—	—	—	—	—	r	r
—	—	—	—	—	—	1 Ex.	—
—	r	—	—	—	—	—	—
rr	r	—	—	—	—	—	

Die Antarctic-

Juli

Ort des Fanges	Lat. 77° 39′ N. Long. 1° 18′ O.	Lat 77° 39′ N. Long. 1° 18′ O.	Lat. 77° 52′ N. Long. 3° 5′ W.	Lat. 77° 52′ N Long. 3 5′ W
Zeit des Fanges	Juli—26—27.	Juli 27.	Juli 28.	Juli 28.
Tiefe des Fanges in Met.	0—500. (Vertikalfang.)	c. 3000. (nahe über d. Boden.)	0—10. (Vertikalfang.)	0—25. (Vertikalfang.)
Salzgehalt des Wassers ‰	33.56—34.89 ‰.	34.34 ‰. (in 3150 M.)	34.38 ‰. (in 0 Met.)	34.38—34.74 ‰.
Temperatur des Wassers ° *Cels.*	3°.85— ÷ 0°.7.	—	+ 3°.63. (in 0 Met.)	+ 3°.63—+ 2°.72.
Globigerina bulloides	—	rr	+	—
»Sternhaarsstatoblast»	—	—	rr (leer)	—
Collozoum inerme	—	—	+	—
Acanthonia tetracopa (veris.)	—	—	r	r
Litholophus articus	—	—	+	r
Lithomelissa thoracites (veris.)	—	—	r	—
Peridinium ovatum	r	—	r	+
» pellucidum	+	—	+	+
Ceratium tripus	r	—	—	—
» » v. arctica	r	—	r	—
Tintinnus denticulatus	r (todt)	—	+ (einige Ex. *mit* Zähnen)	+ (einige Ex. *mit* Zähnen)
» (Cyttarocylis) edentatus	—	—	+	+
Ptychocylis obtusa	—	—	r	—
Aglantha digitale	—	—	—	—
Beroe cucumis	rr	—	—	—
Sagitta arctica	r	—	—	—
Krohnia hamata	r	—	—	r
Anneliden	—	—	—	—
Calanus finmarchicus	+	—	rr	r
» hyperboreus	r	—	—	c (ad. et jun.)
Pseudocalanus elongatus	—	—	—	—
Metridia longa	+	—	—	—
Euchæta norvegica	rr	—	—	—
Heterochæta angulata n. sp.	—	—	—	—
Oithona similis	c	rr	+	c
Oncæa minuta	—	—	—	+
Nauplii und Cyclopen von Copepoden	—	—	c	cc
Conchoecia borealis	—	—	—	—
elegans	—	—	—	—
Euthemisto libellula	—	—	—	—
Parathemisto oblivia	r	—	—	—
Euphausia inermis	rr	—	—	—
Limacina helicina	—	—	r (jun.)	
Fritillaria borealis	—	—	r	—

Expedition.

1898.

Lat. 77° 52′ N. Long. 3° 5′ W.	Lat. 77° 52′ N. Long. 3° 5′ W.	Nahe bei Lat. 77° 52′ N. Long. 3° 5′ W.	Nahe bei Lat. 77° 52′ N. Long. 3° 5′ W.	Lat. 78° 13′ N. Long. 2° 58′ W.	Lat. 78° 13′ N. Long. 2° 58′ W.	Lat. 78° 13′ N. Long. 2° 58′ W.
Juli 28.	Juli 28.	Juli 29.	Juli 29.	Juli 29—30.	Juli 29—30.	Juli 29—30.
0—100. (Vertikalfang.)	0—500. (Vertikalfang.)	0—400. (Vertikalfang.)	0—500. (Vertikalfang.)	0—100. (Vertikalfang.)	0—500. (Vertikalfang.)	0—2600. (Vertikalfang.)
34.38—35.03 ‰.	34.38—35.03 ‰.	—	—	33.76—35.03 ‰.	33.76—35.03 ‰.	33.76—34.96 ‰. (in 2700 Met.).
—	+3°.63—+0°.83.	—	—	+3°.1—+1°.7.	+3°.1—+0°.35.	+3°.1—+1°.48. (in 2700 Met.)
r	—	+	+	+	+	+
—	—	—		—	—	—
—	—	—	—	—	—	—
r	—	—	—	+	—	—
—	—	—	—	—	—	—
—	—	—	—	rr	—	—
+	—	—	—	—	—	r
+	—	—	—	+	+	—
—	—	—	—	—	—	—
+	—	—	—	—	—	—
—	—	—	+	+	+	+ (todt)
r (todt)	—	r	—	+	+	—
—	—	—		—	—	—
—	—	—	—	—	—	rr (jun.)
—	—	—	—	—	—	—
—	—	—	rr	—	—	—
r	rr (jun.)	+	r	—	r	r
—	—	—	—	—	—	rr (jun.)
c	r	cc	cc (= die Hauptmasse)	+	c	+
rr	rr (ad. et jun.)	+	—	r	+	+
r	—	r	+	—	+	r (♀), rr (♂ jun.)
+ (♀)	—	+ (♀ et ♂ jun.)	+ (♀ et ♂ jun.)	—	r	+ (♀)
—	—	rr (♀)	rr (♀)	—	r	rr
—	—	rr (♂)	rr	—	—	—
c	—	+	c	rr	c	+
—	—	+	+ (♂ et ♁)	r	—	—
c	—	c	+	+	c	+
—	—	—	c	rr	c	rr
—	—	—	r	—	—	rr
—	—	rr	r	—	—	—
rr	—	—	r	—	r	r
—	—	—	r (jun.)	—	—	—
—	—	—	r (jun.)	—	r	—
—	—	—	—	—	—	—

Die Antarctic-

August

Ort des Fanges	Lat. 76 36′ N. Long. 12° 13′ O.	Lat. 76° 36′ N. Long. 12° 13′ O.	Lat. 76° 36′ N. Long. 12° 13′ O.	Lat. 76° 36′ N. Long. 12° 13′ O.	Lat. 77° 46′ N Long. 26 18′ O
Zeit des Fanges	Aug. 1.	Aug. 1.	Aug. 1.	Aug. 1.	Aug. 3. (9 Nachm.)
Tiefe des Fanges in Met.	0—25. (Vertikalfang.)	0—50. (Vertikalfang.)	0—100. (Vertikalfang.)	0—500. (Vertikalfang.)	0. (in Treibeis.)
Salzgehalt des Wassers ‰	35.12—35.12 ‰.	35.12—35.13 ‰.	35.12—35.05 ‰.	35.12—35.10 ‰.	30.98 ‰.
Temperatur des Wassers ° *Cels.*	7°.1—5°.8.	7°.1—4°.98.	7°.1—3°.75.	7°.1—2°.5.	1°.23.
Globigerina bulloides	—	—	—	r	—
Acanthonia tetracopa	—	r	r	r	—
Plagiacantha arachnoides	rr	—	—	—	—
Challengeria tridens	—	—	—	r	—
Peridinium divergens v. depressa	—	—	-	—	
» ovatum				—	—
» pellucidum	—		—	—	—
Ceratium tripus v, arctica	r	—	-	r	r
Dinophysis Michaëlis	rr	—	—	—	—
Tintinnus denticulatus	—		—	—	+
» » v. obtusa	—		-	—	—
» (Cyttarocylis) edentatus	--	—		—	—
Ptychocylis acuta	--	—	—	—	-
» obtusa	—	—	—	r	-
» Drygalski	—	—	-	—	—
Codonium princeps		—	—	—	—
Sarsia brachygaster	—	—		-	rr (veris.) (beschädigt)
Sagitta arctica			—	—	—
Krohnia hamata	—		+ (jun.)	—	—
Rotatorien	-	--	—	—	—
Larven von Anneliden	—	—	-	—	-
Calanus finmarchicus	c ad. et jun.)	c (die meisten jun.)	+	c (ad. et jun.)	rr (ad.)
hyperboreus	—		—	—	

[1] In *30* Met. Tiefe. — [2] In *150* Met. Tiefe.

Expedition.

1898.

Svenska Förlandet.	K. Karls ö, Viktoriabugt.	Lat. 77° 48′ N. Long. 32° 53′ O.	Lat. 78° 38′ N. Long. 34° 30′ O.	Lat. 80° 27′ N. Long. 30° 15 O.	Lat. 81° 8′ N. Long. 23° 35′ O.	Lat. 81° 14′ N. Long. 22° 50′ O.	Lat. 81° 14′ N. Long. 22° 50′ O.	Lat. 81° 14′ N. Long. 22′ 50′ O.
Aug. 6. (6 Nachm.)	Aug. 13. (7 Nachm.)	Aug. 15. (9.30 Vorm.)	Aug. 15. (8.30 Nachm.)	Aug. 19 (8 Nachm.)	Aug. 20. (9.30 Nachm.)	Aug. 20. (11 Nachm.)	Aug. 20. (11 Nachm.)	Aug. 20. (11 Nachm.)
0.	0.	0.	0.	0.	0.	0—10. (Vertikalfang.)	0—25. (Vertikalfang.)	0—130. (Vertikalfang.)
32.96 ‰.	33.42 ‰.	33.20 ‰.	33.21 ‰.	32.03 ‰.	32.84 ‰.	32.49—33.42 ‰.	32.49—34.41 ‰ [1].	32.49—34.83 ‰ [2].
+ 1°.0.	+ 1°.56.	+ 1°55.	+ 1°.52.	— 0°.90.	+ 0°71.	+ 0°.38—1°.78.	+ 0°.38—3°.3 [1].	+ 0°.38—1°.98 [2].
—	—	—	—	—	—	+	—	—
—	—	—	—	—	—	—	—	
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	r
—	rr	—	—	—	—	—	—	—
—	—	—	—	—	—	—	r	+
+	—	—	—	r	r	+	+	+
+	r	r	+	r	rr	r	—	—
—	—	—	—	—	—	—	—	—
r	+ (todt)	+	+	+	—	—	—	—
—	—	+	+	r	—	—	—	—
—	—	—	—	—	—	—	r	+
	—	—	—		r	—	—	—
r (todt)	rr	—	+	+	—	r	+	+
—	—	—	—	rr	—	—	—	—
+	—	—	—	—	—	—	—	—
—	—	—	—		—	—		
r	—	—	—	—	—	—	—	r
—	—	—	—	—	—	—	—	—
—	—	—	—	—	+	r	—	—
+	—	—	—	—	—	—	—	—
r (ad.)	r (ad.)	rr (ad.)	rr (ad.)	r (ad.)	—	—	+ (jun.)	r
+	—	—	—	—	—	—	—	—

Ort des Fanges	Lat. 76° 36′ N. Long. 12° 13′ O.	Lat. 76° 36′ N. Long. 12° 13′ O.	Lat. 76° 36′ N. Long. 12° 13′ O.	Lat. 76° 36′ N. Long. 12° 13′ O.	Lat. 77° 46′ N. Long. 26° 18′ O.
Zeit des Fanges	Aug. 1.	Aug. 1.	Aug. 1.	Aug. 1.	Aug. 3. (9 Nachm.)
Tiefe des Fanges in Met.	0—25. (Vertikalfang.)	0—50. (Vertikalfang.)	0—100. (Vertikalfang.)	0—500. (Vertikalfang.)	0. (in Treibeis.)
Salzgehalt des Wassers ‰	35.12—35.12 ‰.	35.12—35.13 ‰.	35.12—35.05 ‰.	35.12—35.10 ‰.	30.98 ‰.
Temperatur des Wassers ° *Cels.*	7°.1—5°.8.	7°.1—4°.98.	7°.1—3°.75.	7°.1—2°.5.	1°.23.
Euchæta norvegica	—	—	—	rr (♀)	—
Metridia longa	—	—	—	+	—
Oithona similis	+	+	+	c	—
Microsetella atlantica	—	—	—	r	—
Oncæa minuta	—	—	—	—	—
Nauplii und Cyclopen von Copepoden	—	cc[3]	c	c	cc[3] (= die Hauptmasse)
Conchoecia borealis	—	—	—	r	
» elegans	—	—	—	rr	—
Euthemisto libellula	r	rr	r	rr	—
Parathemisto oblivia	rr	—	r	—	—
Junge von Mollusken	—	—	—	—	—
Limacina helicina	—	—	—	—	—
Oikopleura Vanhöffeni	—	—	—	—	—
Fritillaria borealis	—	—	—	—	—

[1] In *30* Met. Tiefe. — [2] In *150* Met. Tiefe. — [3] Die Cyclopen den Cal. finmarchicus angehörig.

Svenska Förlandet.	K. Karls ö, Viktoriabugt.	Lat. 77° 48′ N. Long. 32° 53′ O.	Lat. 78° 38′ N. Long. 34° 30′ O.	Lat. 80° 27′ N. Long. 30° 15′ O.	Lat. 81° 8′ N. Long. 23° 35′ O.	Lat. 81° 14′ N. Long. 22° 50′ O.	Lat. 81° 14′ N. Long. 22° 50′ O.	Lat. 81° 14′ N. Long. 22° 50′ O.
Aug. 6. (6 Nachm.)	Aug. 13. (7 Nachm.)	Aug. 15. (9.30 Vorm.)	Aug. 15. (8.30 Nachm.)	Aug. 19. (8 Nachm.)	Aug. 20. (9.30 Nachm.)	Aug. 20. (11 Nachm.)	Aug. 20. (11 Nachm.)	Aug. 20. (11 Nachm.)
0.	0.	0.	0.	0.	0.	0—10. (Vertikalfang.)	0—25. (Vertikalfang.)	0—130. (Vertikalfang.)
32.96 ‰.	33.42 ‰.	33.20 ‰.	33.21 ‰.	32.03 ‰.	32.84 ‰.	32.49—33.42 ‰.	32.49—34.41 ‰.[1]	32.49—34.83 ‰.[2]
− 1°.0.	+ 1°.56.	+ 1°.55.	+ 1°.52.	— 0°.90.	+ 0°.71.	+ 0°.38—1°.78.	+ 0°.38—3°.3[1].	+ 0°.38—1°.98[2].
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
c	r	r	c	+	rr	—	c	c
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	r
cc³ (= die Hauptmasse)	cc³ (= die Hauptmasse)	cc³ (= die Hauptmasse)	cc³ (= die Hauptmasse)	cc³ (= die Hauptmasse)	—	+	+	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—		—	—	—
—	—	—	—	—		—	—	—
—	—	—	r	—	—	—	—	+
+ (jun.)	—	—	—	—	—	rr (ad.)	—	—
rr	—	—	—	—	—	—	—	—
r	—	+	—	+	—	—	r	r

Die Antarctic-

August

Ort des Fanges	Lat. 80° 31′ N. Long. 18 50′ O.	Lat. 80° 8′ N. Long. 16° 32′ O.	Lat. 79° 53′ N. Long. 11° 22′ O.	Der Hafen Virgo's.
Zeit des Fanges	August 21. (1 Nachm.)	August 24. (12 Mitt.)	August 25. (9 Vorm.)	August 26—27
Tiefe des Fanges in Met.	0. (in Treibeis.)	0.	0.	0.
Salzgehalt des Wassers ‰	33.93 ‰.	33.59 ‰.	33.75 ‰.	33.32 ‰.
Temperatur des Wassers ° *Cels.*	+ 2°.42.	+ 3°.44.	+ 2°.77.	+ 3°.6.
Globigerina bulloides	—	—	—	—
Acanthonia tetracopa	—	—	—	—
Plagiacantha arachnoides	—	—	—	—
Litholophus arcticus	—	—	—	—
Rhizophlegma sp.			—	—
Challengeria tridens	—		—	—
Diplopsalis lenticula	r	—	—	—
Peridinium divergens v. depressa	+	r	—	—
» ovatum	c	—	—	—
» pellucidum	c	—	—	—
Ceratium tripus v. arctica	r	+	r	
» fusus	—	—	—	—
Dinophysis Michaëlis	r	—	—	—
» sphærica	+	—	—	—
Tintinnus denticulatus	—	—	—	—
» (Cyttarocylis) edentatus	r (aber: Rand *gezähnt!*)	—	—	—
» secatus			—	—
Ptychocylis acuta	r (todt)	—		—
» Drygalski	—		—	—
Sarsia brachygaster	—	-	—	rr
Catablema vesicarium		—	—	rr
Solmundus glacialis	—	—		rr
Cyanea arctica	—	—	—	rr
Pluteus von Spatangiden			—	-
Krohnia hamata			—	—

[1] In *430* Met. Tiefe.

Expedition.

1898.

Lat. 79° 58′ N. Long. 9° 35′ O.	Lat. 79° 58′ N. Long. 9° 35′ O.	Lat. 78° 58′ N. Long. 9° 35′ O.	Lat. 78° 23′ N. Long. 10° 23′ O.	Lat. 76° 45′ N. Long. 8° 45′ O.	Lat. 76° 27′ N. Long. 10° 43′ O.	Lat. 76° 12′ N. Long. 12° 18′ O.
August 27. (10—12 Nachm.)	August 27. (10—12 Nachm.)	August 27. (10—12 Nachm.)	August 28. (8 Nachm.)	August 30. (9 Nachm.)	August 31. (9 Vorm.)	August 31. (8 Nachm.)
0—10. Vertikalfang.)	0—100. (Vertikalfang.)	0—400. (Vertikalfang.)	0.	0.	0.	0.
34.53—? ‰.	34.53—35.12 ‰.	34.53—35.06 ‰ [1].	34.94 ‰.	34.92 ‰.	35.03 ‰.	35.15 ‰.
+°.58—?	+ 4°.58—+ 3°.7.	+ 4°.58—+ 1°.5 [1].	+ 6°.06.	+ 5°.34.	+ 5°.35.	+ 6°.26.
—	+	—	—	+	+	+
r	+	r	—	—	—	r
—	r	—	—	—	r	r
—	—	r	—	—	—	—
—	r	rr	—	—	—	—
—	r	r	—	—	—	—
—	—	—	—	—	—	—
+	—	—	—	—	—	—
+	+	+	—	—	—	—
+	+	+	—	—	—	—
—	c	—	+	+	—	+
—	—	—	—	—	—	rr
—	—	—	—	—	—	—
—	—	—	—	—	—	—
r	+	—	r (todt)	—	—	—
rr	r	r	—	—	r	r
+	+	r	—	—	r	—
+	+ (todt)	r	—	—	—	—
—	—	r	—	—	—	—
—	—	—	—	—	—	—
—	—	—			—	—
—	—	-				—
—	—	—	—	—	—	—
—	—	r	—	—	—	—
—	r	+	—	—	—	—

Ort des Fanges	Lat. 80° 31′ N. Long. 18° 50′ O.	Lat. 80° 8′ N. Long. 16° 32′ O.	Lat. 79° 53′ N. Long. 11° 22′ O.	Der Hafen Virgo's.
Zeit des Fanges	August 21. (1 Nachm.)	August 12. (12 Mitt.)	August 25. (9 Vorm.)	August 26—27.
Tiefe des Fanges in Met.	0. (im Treibeis).	0.	0.	0.
Salzgehalt des Wassers ‰	33.93 ‰.	33.59 ‰.	33.75 ‰.	33.32 ‰.
Temperatur des Wassers ° *Cels*	+ 2°.42.	+ 3°.44.	+ 2°.77.	+ 3°.6.
Calanus finmarchicus	—	r (jun.)	r	—
» hyperboreus	—	—	—	—
Pseudocalanus elongatus	—	—	—	—
Euchaeta norvegica			—	—
Metridia longa	—	—	—	—
Oithona similis	+	+	+	+
Microsetella atlantica	—	—	—	—
Nauplii und Cyclopen von Copepoden	c	c	+	—
Conchoecia borealis	—	—	—	—
» elegans	—	—	—	—
Hyperia galba	—	—	—	rr (♀)
Euthemisto libellula	—	—	—	—
Parathemisto oblivia	—	—	—	—
Euphausia inermis	—	—	—	—
Megalopa von Brachyuren	—	—	—	—
Junge von Mollusken	—	—	—	+
Limacina helicina	—	—	—	r
Clione limacina	—	—	—	rr
Fritillaria borealis	—	+	+	—

Lat. 79° 58′ N. long. 9° 35′ O.	Lat. 79° 58′ N. Long. 9° 35′ O.	Lat. 78° 58′ N. Long. 9° 35′ O.	Lat. 78° 23′ N. Long. 10° 23′ O.	Lat. 76° 45′ N. Long. 8° 45′ O.	Lat. 76° 27′ N Long. 10° 43′ O.	Lat. 76° 12′ N. Long. 12° 18′ O.
August 27. (10—12 Nachm.)	August 27. (10—12 Nachm.)	August 27. (10—12 Nachm.)	August 28. (8 Nachm.)	August 30. (9 Nachm.)	August 31. (9 Vorm.)	August 31. (8 Nachm.)
0—10. (Vertikalfang.)	0—100. (Vertikalfang.)	0—400. (Vertikalfang.)	0.	0.	0.	0.
34.53—? ‰.	34.53—35.12 ‰.	34.53—35.06 ‰ [1].	34.94 ‰.	34.92 ‰.	35.03 ‰.	35.15 ‰.
+ 4°.58—?	+ 4°.58—+ 3°.7.	+ 4°.58—+ 1°.5 [1].	+ 6°.06.	+ 5°.34.	+ 5°.35.	+ 6°.26.
r (jun.)	+ (ad. et jun.)	c	r (ad.)	—	r	r
—	—	rr (♀)	—	—	—	—
—	+	—	r	—	—	—
—	—	rr (♂ jun.); rr (♀)	—	—	—	—
—	—	rr (♀)	—	—	—	—
+	+	c	r	c	+	c
—	—	—	—	+	—	r
—	—	c	cc (= die Hauptmasse)	cc (= die Hauptmasse)	c	cc
—	—	r	—	—	—	—
—	—	r	—	—	—	—
—	—	—	—	—	—	
—	—	rr	—	—	r	—
—	—	r	—	—	—	—
—	—	—	r	—	—	—
—	—	—	—	—	—	c
—	—	—	—	—	—	—
—	—	—	—	—	—	—
—	—	—	—	—	—	—
+	+	—	r	—	r	r

Die Antarctic-

September

Ort des Fanges	Lat. 76° 2′ N. Long. 13° 8′ O.	Lat. 75° 50′ N. Long. 15° 25′ O.	Lat. 75° 50′ N. Long. 15° 32′ O.	Lat. 75° 24′ N. Long. 16° 47′ O.	Lat. 74° 42′ N. Long. 16° 42′ O.
Zeit des Fanges	September 1. (9 Vorm.)	September 1.	September 2. (9 Vorm.)	September 2. (8 Nachm.)	September 3. (9 Vorm.)
Tiefe des Fanges, in Met.	0.	0—325.	0.	0.	0.
Salzgehalt des Wassers ‰	35.13 ‰.	34.91—35.13 ‰ [2].	35.01 ‰.	35.12 ‰.	35.17 ‰.
Temperatur des Wassers ° *Cels.*	+ 6°.61.	+ 5°.73—2°.73 [2].	+ 5°.52.	+ 5°.64.	+ 7°.24.
Globigerina bulloides	r	r	+	+	r
Acanthonia quadrifolio	—	—	—	—	—
Acanthostaurus pallidus	—	rr	—	—	—
Plagiacantha arachnoides	+	r	—	r	c
Litholophus arcticus	—	—	—	—	—
Rhizophlegma sp.	—	rr	—	—	—
Lithomelissa thoracites	—	rr	—	—	—
Challengeria tridens	—	+	—	—	—
Diplopsalis lenticula	—	rr	—	—	—
Peridinium divergens	—	—	—	—	—
» » v. depressa	—	r	r	—	r
» ovatum	r	—	—	—	—
» pellucidens	—	+	—	—	—
Ceratium tripus	—	—	—	—	—
» » v. arctica	+	—	—	+	c
» » v. bucephalus	—	—	—	—	—
» » v. macroceros	—	—	—	—	—
» fusus	rr	—	—	+	—
» furca	—	—	r	+	—
Dinophysis acuta	—	—	—	—	—
» Michaëlis	—	rr	—	—	—
Gonyaulax spinifera	—	—	—	—	—
Tintinnus denticulatus	+	—	—	+ (todt)	—
» (Cyttarocylis) edentatus	r	+ (auch bezähnt)	—	r todt)	r
» secatus	—	rr	—	—	—
» urnula	—	—	—	—	—

[1] In 200 Met. Tiefe. — [2] In 350 Met. Tiefe.

Expedition.

1898.

Lat. 74° 16′ N. Long. 19° 10′ O.	Lat. 73° 58′ N. Long. 19° 3′ O.	Lat. 73° 36′ N. Long. 18° 50′ O.	Lat. 72° 43′ N. Long. 18° 43′ O.	Lat. 72° 29′ N. Long. 18° 48′ O.	Lat. 71° 57′ N. Long. 19° 0′ O.	Lat. 71° 50′ N. Long. 19° 2′ O.	Lat. 71° 14′ N. Long. 19° 38′ O.	Lat. 70° 23′ N. Long. 20° 32′ O.
September 3. (8 Nachm.)	September 3. (12 Nachm.)	September 4. (4 Vorm.)	September 4. (9 Nachm.)	September 4. (12 Mittern.)	September 5. (9 Vorm.)	September 5. (10 Vorm.)	September 5. (9 Nachm.)	September 6. (9 Vorm.)
0.	0.	0.	0.	0.	0.	0—230.	0.	0.
34.36 ‰.	34.67 ‰.	35.03 ‰.	35.01 ‰.	35.04 ‰.	34.96 ‰.	34.96—35.13 ‰ [1].	34.92 ‰.	34.41 ‰.
+ 2°.83.	+ 5°.08.	+ 7°.06.	+ 4°.8.	+ 8°.87.	+ 9°.08.	+ 9°.8 – + 5°.5 [1].	+ 9°.40.	+ 9°.37.
—	—	—	r	c	cc	r	+	—
—	—	—	+	—	c	r	—	—
—	—	—	—	r	+	r	—	—
—	—	r	—	rr (todt)	—	—	—	—
—	—	r	—	—	—	r	r	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	r	—	—
—	—	—	—	—	—	r	—	—
—	—	—	—	—	—	+	—	+
—	—	c	r	+	+	+	+	+
—	—	—	—	—	—	+	—	—
—	—	—	—	—	—	c	—	—
—	—	—	+	c	c	c	c	c
—	+	c	+	c	c	c	c	c
—	—	—	—	r	—	—	—	—
—	—	—	+	c	c	c	c	c
—	—	+	+	+	+	+	+	+
—	—	+	+	+ (ph)	+ (dh)	+ (ph, dh)	+ (ph, dh)	c (ph, dh)
—	—	—	—	—	—	r	—	—
—	—	—	—	—	—	r	—	—
—	—	—	—	—	—	r	—	—
rr	—	+	+	—	—	+	+	r
—	—	r	—	—	—	r (auch bezähnt)	—	—
—	—	—	—	—	—	—	—	—
—	—	—	—	—	+ (todt)	+	—	—

Ort des Fanges	Lat. 76′ 2′ N. Long. 13° 8′ O.	Lat. 75° 50′ N. Long. 15° 25′ O.	Lat. 75° 50′ N. Long. 15° 32′ O.	Lat. 75° 24′ N. Long. 16° 47′ O.	Lat. 74° 42′ N. Long. 16° 42′ O.
Zeit des Fanges	September 1. (9 Vorm.)	September 1.	September 2. (9 Vorm.)	September 2. (8 Nachm.)	September 3. (9 Vorm.)
Tiefe des Fanges in Met.	0.	0—325.	0.	0.	0.
Salzgehalt des Wassers ‰	35.13 ‰.	34.91—35.13 ‰ [2].	35.01 ‰.	35.12 ‰.	35.17 ‰.
Temperatur des Wassers ° *Cels.*	+ 6°.61.	+ 5°.73—2°.73 [2].	+ 5°.01.	+ 5°.64.	+ 7°.24.
Tintinnus (Ptychocylis) obtusa	—	+	—	—	—
» » acuta	r	—	—	r (todt)	+
Pluteus von Spatangiden	—	—	—	r	—
Ophiuriden, soeben ausgebildet	—	—	—	—	—
Rotatorien (veris.)	—	—	—	—	—
Sagitta arctica	—	rr	—	—	—
Anneliden	—	—	—	—	—
Calanus finmarchicus	—	c	—	c	—
» hyperboreus	—	—	—	—	—
Pseudocalanus elongatus	—	r	—	—	—
Euchæta norvegica	—	—			—
Anomalocera Patersoni	—	—	—	—	—
Acartia Clausi	—	—	—	—	—
Oithona similis	+	c	c	+	c
Microsetella atlantica	—	—	—	—	—
Oncæa minuta	—	r	—	—	—
Nauplii und Cyclopen von Copepoden	c	—	cc	c	c [3]
Evadne Nordmanni	—	—	—	—	—
Podon polyphemoides	—	—	—	—	—
Euphausia inermis	—	rr	—	—	—
Hyperoche Kröyeri	—	—	—	—	—
Euthemisto libellula	—	—	rr	—	—
Parathemisto oblivia	r	—	—	—	—
Megalopa von Brachyuren	+	rr	r	—	—
Larven von Opisthobranchien	—	—	r	—	—
Junge von Mollusken	—	—	+	+	—
Clione limacina	—	—	—	—	—
Limacina balea	—	—	—	—	—
» helicina	—		—		—
Cyphonautes	—	—	—	—	—
Fritillaria borealis	r	—	r	—	—

[1] In 200 Met. Tiefe. — [2] In 350 Met. Tiefe. — [3] Die Cyclopen den Cal. finm. angehörig.

Lat. 74° 16′ N. Long. 19° 10′ O.	Lat. 75° 48′ N. Long. 19° 3′ O.	Lat. 73° 36′ N. Long. 18° 50′ O.	Lat. 72° 43′ N. Long. 18° 43′ O.	Lat. 72° 29′ N. Long. 18° 48′ O.	Lat. 71° 57′ N. Long. 19° 0′ O.	Lat. 71° 50′ N. Long. 19° 2′ O.	Lat. 71° 14′ N. Long. 19° 38′ O.	Lat. 70° 23′ N. Long. 20° 23′ O.
September 3. (8 Nachm.)	September 3. (12 Nachm.)	September 4. (4 Vorm.)	September 4. (9 Nachm.)	September 4. (12 Mittern.)	September 5. (9 Vorm.)	September 5. (10 Vorm.)	September 5. (9 Nachm.)	September 6. (9 Vorm.)
0.	0.	0.	0.	0.	0.	0—230.	0.	0.
34.36 ‰.	34.67 ‰.	35.03 ‰.	35.01 ‰.	35.04 ‰.	34.96 ‰.	34.96—35 13 ‰ [1].	34.92 ‰.	34.41 ‰.
+ 2°.83.	+ 5°.08.	+ 7°.06.	+ 8°.8.	+ 8°,87.	+ 9°.08.	+ 9°.8— + 5°.5[1].	+ 9°.40.	+ 9°.37.
—	—	r	—	—	—	—	—	—
—	—	r (todt)	—	+	—	r	—	—
—	—	rr	—	—	—	—	—	—
—	—	—	—	—	—	—	rr	—
—	—	c	—	—	—	—	—	—
—		—	—	—	—	—	—	—
r	—	—	—	—	—	—	—	—
cc	r	+	+ (die meisten jun.)	cc	—	—	c (die meisten jun.)	+
—	rr	—	—	—	—	—	—	—
r	r	—	—	—	—	—	—	—
—	—	—	—	—	—	rr (♀)	—	—
—	—	—	r (♂)	r (♂ ad. et ♀ ad.)	—	—	r	r (♂ et ♀ jun.)
—	r	+	r	—	—	—	+	+
r	r	+	+	c	c	c	c	c
—	r	—	+	r	—	—	—	—
—	—	—	—	—		—	—	
—	—	c	cc	—	cc	—	cc	—
—	—	—	—	—	—	—	—	r
—	—	—	—	—	—	—	—	r
—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	r	—
—	—	—	—	—	—	—	—	—
—	—		—	—	—	r	—	—
—	—	—	—	—	—	—		—
—	r	+	—	—	—	—	—	—
—	—	+	+	—	—	—	+	+
—	r	—	—	—	—	—	—	—
—	—	—	—	—	—		+	—
—	r	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	r
—	—	+	—	—	—	—	—	—

KONGL. SVENSKA VETENSKAPS-AKADEMIENS HANDLINGAR. Bandet 32. N:o 7.

PLANKTON-RESEARCHES

IN 1897

BY

P. T. CLEVE.

COMMUNICATED TO THE R. SWEDISH ACADEMY OF SCIENCES SEPTEMBER 13TH 1899.

STOCKHOLM
KUNGL. BOKTRYCKERIET. P. A. NORSTEDT & SÖNER
1899

I. Plankton of the North Sea in 1897.

I have already[1] reported on the state of the North Sea in winter (January and February). The region has since then been explored by Swedish steamers during April—May, July—August and October—November, and a quantity of material has been obtained which affords a good insight into the annual changes in the plankton of the North Sea. To understand these changes it must be borne in mind that, as proved by hydrographical researches, the water of the Atlantic enters the North Sea both by the north of Scotland and through the English Channel. Of considerable importance are also the researches of Mr. Wemyss Fulton on the currents of the North Sea.[2] The results of these investigations are summarised as follows:

1. »There is at all seasons a fairly constant slow circulation of the surface water in the North Sea, Atlantic water entering round the north of Scotland, and passing southwards along the east coasts of Scotland and England, as far as the neighbourhood of the Wash, then in an E.N.E. direction towards the coast of Denmark, and then northerly along the Danish coast. The surface water may or may not enter the Skagerak and penetrate to the west coast of Sweden and Norway, according to the prevailing wind The main body passes up the west coast of Norway and joins the Atlantic stream. The limit between the north-going eastern stream and the south-going western stream varies greatly, probably according to the prevailing wind; but as a rule the extent of the former is greater.»

2. »The movements of the surface water in confined areas, like the western part of the Moray Firth, and the Firth of Forth, is irregular, and depends upon variations in the winds and the tides.»

3. »The speed of the movement is usually about two or three geographical miles a day, but may be much accelerated or retarded by the action of the wind.»

From the above hydrographical statements it appears that the plankton of the northern part of the North Sea (i. e. above the 100 and 200 metre plateaus) is furnished by the Atlantic, north of Scotland. The plankton of the southern part (i. e. above the 50 metre plateau north of the continental coast) which I have called the *didymus-plankton*, on the other hand, is derived partly at least, from the English Channel. A part of it

[1] A treatise on the phytoplankton of the Atlantic and its tributaries, Upsala 1897. 4°.
[2] Fifteenth annual report of the Fishery Board for Scotland. 1897, pag. 334.

may be derived from the Scottish current. To aid us in ascertaining what forms are due to one or the other origin we have a considerable number of observations for the year 1897. M. OSTENFELD of Copenhagen has published[1] a valuable report on the plankton collected throughout the year on the routes: Shetlands—Iceland and Shetlands—Greenland. I have also examined a series of samples from Plymouth, for which I am indebted to the kind assistance of Mr. ALLEN, the director of the marine biological laboratory in that town. Another set of samples has been obtained from the Dutch marine laboratory at Helder and I take this opportunity of thanking Dr. P. HOEK, the director of the laboratory. The Swedish Andrée-Expedition to Spitzbergen has brought home materials contributing to the knowledge of the state of the plankton along the Norwegian coast and at Spitzbergen.[2]

All these materials will be discussed in the following pages.

1. North Sea January—February 1897.

From my paper: »A treatise on the phytoplankton of the Atlantic and its tributaries» I quote the following summary:

1. **Tripos-plankton.** This kind characterises water with a salinity of 35 p. mille and a temperature of 6°, which extends east of Scotland, above the 100 metre plateau. Eastwards the salinity becomes lowered by the admixture of water from the Baltic current.

2. **Concinnus-plankton.** Outside the tripos-region and above the 50 metre plateau *Coscinodiscus concinnus* and *Halosphæra viridis* occur abundantly, and it is easily seen on the map in my above-mentioned paper that these forms have spread with the Scottish current. The salinity of the water with this plankton is as a rule about 34 p. mille, but is influenced by the admixture of the continental water. The plankton with *Coscinodiscus concinnus* was predominant also at Plymouth, and it seems probable that it had been forced out of the North Sea during the abnormal meteorological state that prevailed at that time of the year.

The region between the Shetlands and Iceland was, to judge from the report of OSTENFELD, exceedingly poor in plankton in January and February, containing only a few rare specimens, doubtless remnants from past epochs.

3. **Tricho-plankton.** Skagerak was covered by a thin sheet of water from the Baltic current, which had spread over a mass of water with a salinity of 34 p. mille and a temp. of about 6°. The prevailing plankton in the water last named was *thricho-plankton*, which we may assume to have come through the deep Norwegian fissure, probably from the western Atlantic.

[1] Iagttagelser over overfladvandets temperatur, saltholdighed og plankton paa islandske og grönlandske skibsruter in 1897. Copenhagen 1898. 8°.

[2] Bih. t. K. Sv. Vet. Ahad. Handl. XXIII. 2. N:o 4.

2. North Sea April—May 1897.

The samples collected by the Swedish steamers at the end of April and in the beginning of May prove that considerable changes had occurred since the winter.

1. **Chæto-plankton.** The broad tongue of water with a salinity of 35 p. mille and temperature 5,6 to 7,5[1] contains *chæto-plankton* chiefly. This kind extends to the Shetlands, Färöes and south Iceland. It occurs also abundantly in Skagerak. It was not found at Plymouth, but occurred there abundantly in November and December of 1896, and remnants lingered there still in January and February of 1897. At Iceland and at the Färöes it began to appear in March.

In the southern North Sea (i. e. above the 50 metre plateau) *Chætoceros decipiens* did not occur to any important extent, but its place was there taken by the flagellate *Phæocystis Pouchetii,* which I consider as connected with the chæto-plankton. The slimy masses of the last named organism were found at Helder and north of that station in immense quantities.

It is from the above apparent that the chæto-plankton already began to develop in the mouth of the English Channel in December 1896, arrived at the Färöes and Iceland in March and was enormously developed in April and May. As to the origin of the chæto-plankton I defer the discussion to a future publication. From the collections of the Swedish Expedition to Spitzbergen it is evident that the chæto-plankton appeared there in the middle of July and as it had then disappeared on the route Iceland—Färöes—Shetlands and from the North Sea, it might be assumed that it had migrated towards Spitzbergen, where it was found abundantly in the middle of August, in Hinlopen Strait, but this hypothesis would presuppose a greater velocity of currents than is usually admitted.

2. **Northern and arctic neritic plankton.** The chæto-plankton of the North Sea is bordered by a band containing a number of arctic and northern forms, belonging to the sira-, tricho- and northern neritic types. As these forms are all derived from the north-west and occur intermingled, I treat of them in the following as *northern neritic plankton.* This plankton appears abundantly at the north end of Scotland and in a band above the limit between the 50 metre and 100 metre plateaus. It continues along the west of Scotland to the south of Iceland, and to the east along the Norwegian coast into Skagerak. Similar neritic plankton also occurs sparingly in water of 35 p. mille salinity from the Shetlands along the 60th degree of lat. to the region of the submarine ridge, discovered by the Ingolf expedition and called »Reykianäs Ryg» which extends to the south west from Iceland. West of the Reykianäs Ryg, which seems to have a great influence upon the currents, *styliplankton* is the ruling type.

As it is of considerable interest to examine the distribution of the forms which constitute the northern neritic plankton as defined above, I will treat of each species separately.

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[1] See O. Pettersson and G. Ekman. Bih. t. K. Sv. Vet. Akad. Handl. Vol. XXV. Part II. No 1. 1899.

Dinobryum pellucidum occurs in Skagerak and on the Norwegian coast, 60° N. 5° E.

Ceratium tripos var. longipes rules in the North-Sea and along the Norwegian coast. It occurs sparingly at the Shetlands, is not rare N.W. of the Hebrides, but was not seen at Iceland.

Peridinium depressum, which seems to me to differ sufficiently from *P. divergens* to constitute a separate species, appears on the whole to accompany the preceding.

Asterionella spathulifera CL. OSTENFELD considers this species the same as *A. glacialis* CASTR., which seems to me also probable, although not sufficiently proved. This remarkable diatom seems to have a station in the fjords of the south of Iceland. It was found abundantly at Helder and in April also at Plymouth. On the other hand it was observed neither on the route Shetlands—Greenland nor along the Norwegian coast. It seems to invade the British Islands in the spring, following the east coast down to the continental shores of the North Sea. It was found in April 1895 together with other northern forms east of the Wash and, later, in July, according to a letter from Prof. BEYENINCK of Delft, along the Dutch coast in such immense quantities that it coloured the sea coffee-brown and left on the shore a stratum of one centimetre in thickness, thus representing millions of kilogrammes. At the end of the same month it had disappeared.

Biddulphia aurita appeared together with other northern and arctic forms in the beginning of April at Helder, from whence it soon disappeared completely. It is not mentioned from the routes Färöes—Shetlands and Shetlands—Greenland.

Chætoceros atlanticus, rare south of Iceland, around the Färöes and west of Scotland; very sparingly on »Reykianäs Ryg».

C. borealis, not found at Helder and Plymouth. As OSTENFELD has not distinguished between the type and the varieties nothing can be stated about its western distribution.

C. diadema occurred south of Iceland and abundantly at the Shetlands, but not in the Färöe Channel and along the coast of Norway.

C. hiemalis, found rarely at Cape Stadt in Norway.

C. laciniosus, not found off Norway but plentiful near the Shetlands and Färöes, sparingly south of Iceland, but abundantly along the 60th degree of lat. between 11° and 37° W.

C. scolopendra, not found along the Norwegian coast and not on the route Shetlands —Greenland, but sparingly at Färöes. The same may be said about *C. teres*.

Corethron hystrix was found in February at Plymouth, in March off the Hebrides, but not along the Norwegian coast. This species belongs to the styli-plankton.

Coscinodiscus oculus iridis occured very sparingly along the Norwegian coast, was not rare on the route Shetlands—Iceland nor off the south-west of Greenland.

C. polychordus was seen in March at the Hebrides, not along the Norwegian coast and is not mentioned by OSTENFELD.

Lauderia annulata belongs to the styli-plankton and is derived probably from West Scotland, where it was seen in the autumn of 1896.

Nitzschia seriata was not seen off Norway, but plentifully at Färöes. It was also seen abundantly along the 60th degree of lat. from 11° W. to the »Reykianäs Ryg». It follows *Chætoceros laciniosus*.

Rhizosolenia obtusa, rare in the Färöe Channel and on the southern coast of Norway.

R. semispina, common off the Färöes, not rare off Scotland, more or less sparingly from the Shetlands to Greenland. Rare at Plymouth and on some spots west of Norway.

Thalassiosira gravida, rare off Spitzbergen, in the Färöe Channel and south of Greenland.

T. Nordenskiöldi, common off the Shetlands, not rare south of Iceland.

Thalassiothrix Frauenfeldii, sparingly along the 60th degree of lat. to »Reykianäs Ryg»; not seen in the Färöe Channel.

T. longissima is not mentioned from the route Shetlands—Iceland, but is found sparingly about 57° 30′ N. and 36° W. (along with the styli-plankton).

Halosphæra viridis has been seen off the Shetlands, but not on the routes Shetlands —Iceland and Shetlands—Greenland; thus it is probably a remnant from the winter, during which period it occurred south of the Färöes. — Belongs to styli-plankton.

The above facts point to the conclusion that the northern and arctic forms, which bordered the area of the chæto-plankton, are derived from south Iceland and the Shetlands.

3. **Styli-plankton** was found at a spot west of Scotland, and, to a small amount, off the Färöes and Shetlands. This plankton-type appeared contemporaneously at the south-east of Greenland, close above the western slope of the »Reykianäs Ryg».

4. **Tripos-plankton** prevails on the west of the Danish peninsula, from whence it passes into Skagerak together with chæto-plankton and northern neritic plankton.

3. North Sea in July—August 1897.

The state of the plankton has considerably changed since the spring. The *chæto-plankton* has disappeared entirely, and of the *northern neritic plankton* a small remnant only lingers on the Dutch coast. On the other hand the *tripos-plankton* has now become the predominant kind in the greater part of the North Sea. *Southern neritic plankton* predominates in the southern North Sea at Helder and, mixed with styli-plankton, on the west of the Danish peninsula.

Outside the North Sea the styli-plankton prevails off the Shetlands and Färöes.

At Plymouth the plankton is now remarkably poor; and the water of 35 p. mille salinity between Norway and Spitzbergen contains styli-plankton very sparingly.

I now give an account of the species, which constitute the tripos-plankton and the southern neritic plankton and occur simultaneously at this season.

The animals have, unfortunately, not been examined, with the exception of *Noctiluca miliaris*, which is very characteristic of the southern neritic plankton. This organism occurred abundantly at Plymouth from the beginning of July and at Helder from the end of June to the end of September.

Ceratium tripos occurs at this season in the same region as *Chætoceros decipiens* did in the spring. It cannot be assumed that the tripos-plankton has been removed from the region west of Danish peninsula, as the water there had a low salinity in the spring

(30 to 33 p. mille) while the water in the central part of the North Sea had in the summer a salinity of 35 p. mille. It seems as if the *Ceratium tripos* came round the north of Scotland in the summer and found in the North Sea the most favorable conditions for its enormous development.

C. (*tripos var.*) *macroceros*, which is to be considered as a distinct species, is as a rule very rare in the spring, but, in the summer, becomes abundant in the whole of the North Sea and along the Scandinavian coasts, as far as Lofoden.

Bacteriastrum varians occurs off the Dutch coast and west of Skagen. It is not mentioned by OSTENFELD as occurring in the northern Atlantic.

Chætoceros densus follows *Bacteriastrum varians.*

C. curvisetus was met with north-west of Skagerak and west of Bergen, but is not mentioned by OSTENFELD as occurring on the route Shetlands—Iceland. It was very common along the Swedish coast from the middle of July and it was seen also at Helder in the same month. It is thus a southern species, which in the summer spreads along the south coast of the North Sea into Skagerak and from there passes with the Baltic current along the Norwegian coast. As it was abundantly found in the autumn of 1896 off the west of Scotland, it also seems to proceed northwards along the west coast of England.

C. didymus and especially *C. Schüttii* follow *C. curvisetus.*

Guinardia flaccida appeared in May at Plymouth and from the middle of June at Helder.

Rhizosolenia Shrubsolei was found more or less abundantly from May to October at Plymouth and in June and July at Helder. It was also found, but sparingly, in the styli-plankton off the Shetlands.

R. Stolterfothii appeared in May at Plymouth, and in July at Helder. It does not, as a rule, reach Skagerak. OSTENFELD mentions it as occurring sparingly at the Shetlands.

R. styliformis. The occurrence of this species west of the Danish peninsula, and its almost complete absence from other parts of the North Sea lead to the conclusion that it had been carried by a current from the English Channel, since it had been observed, although sparingly, in May and June at Plymouth.

4. North Sea in October—November 1897.

The state of the plankton prevailing in July and August has not been much altered. Now, as then, the *tripos-plankton* is the prevailing type, but a number of species, not seen before, appear, the origin of which can be traced partly from Scotland and partly from the English Channel, and which belong partly to the styli-plankton and partly to the neritic plankton of the British Islands.

The *styli-plankton* appears both off the coast of Scotland, down to Newcastle, and on the west of the Danish peninsula.

One species of the *northern neritic plankton-type, Ceratium tripos v. longipes*, was found along the Dutch coast, but there mixed with southern neritic forms and some species which can be traced from Scotland. As this dinoflagellate appeared also in July

—August in the north of Holland, it may either be a remnant or may have been carried down from Scotland.

Outside the North Sea the *tripos-plankton* extends from the northwest of Scotland towards Iceland, but in that region, it is mixed with styli-plankton.

West of Scotland to about 15° W. the styli-plankton is mixed with *Thalassiothrix Frauenfeldii* and *T. longissima*, belonging to the tricho-plankton. The region between 15° W. and Greenland is almost sterile, which is remarkable, as it is just there that *Thalassiotrix longissima* usually abounds in the summer.

As stated above, the species which occur in the North Sea are partly remnants from the summer and partly new. The latter can be classed as derived from the north of Scotland and from the English Channel.

I consider the following as remnants from the summer:

Ceratium furca and *C. fusus*, which in the summer occurred in the western North Sea, have now spread over the whole area.

C. tripos and *C. macroceros* occur now as formerly over the whole North Sea.

Bacteriastrum varians keeps to the southern part of the North Sea and approaches Skagerak.

Chætoceros curvisetus is, as before, confined to the Skagerak.

C. densus has advanced from the southern North Sea towards Skagerak.

C. didymus is confined to the Skagerak.

C. Schüttii occurs now in such a manner, as to appear to belong to the styli-plankton. This species was found in July at Helder, in August and September at Plymouth, in October along the 60° N. from 14° W. to the Shetlands, and remained in November in the south of the Färöes. It was seen also west and east of Scotland. The conclusion which may be drawn from these statements is, that *C. Schüttii* spreads in the summer through the English Channel along the continental coast and on the west of England to the Färöes and round Scotland into the North Sea, where it arrives in the autumn. As this species is common in the Skagerak in the summer it may be assumed that it arrives there along the continental coast.

Coscinodiscus concinnus, almost absent from the North Sea in the summer, occurs now, together with *Biddulphia mobilensis* and *Halosphæra viridis*, along the Scottish, continental and Danish coasts. The *Coscinodiscus* and *Biddulphia* seem to live the whole year round the British coasts, but *Halosphæra* has evidently spread from the south of the Färöes, where it was found abundantly in the beginning of November. In all cases these three species have been carried into the North Sea by the south going Scottish current.

Guinardia flaccida is found, as before, along the continental coast.

Rhizosolenia gracillima is confined, as before, to the Skagerak.

R. semispina occurs, as before, on the east in rare specimens only.

R. Shrubsolei continues to be rare.

R. Stolterfothii occurred in September and October both at Plymouth and at Helder. It was found also west of Scotland, but does not enter into the Scottish current.

Ceratium tripos var. bucephala is abundant round Scotland and spreads along the 57th degree N. into the Skagerak.

Stephanopyxis turgida has about the same distribution.

I consider that the following species arrive from the north of Scotland in the North Sea:

Ceratium furca.
C. fusus.
C. tripos v. bucephala.
Biddulphia mobilensis.
Coscinodiscus concinnus.
Coscinodiscus oculus iridis.
Rhizosolenia styliformis (also through the English Channel).
Stephanopyxis turgida.
Halosphæra viridis.

Among species, which occur in the southern North Sea and arrived through the English Channel, I note the following:

Cerataulina Bergonii. This species appeared at Helder in April and May, and was found at Plymouth in July and October. It has not been mentioned by Ostenfeld as found in the northern Atlantic.

Ditylum Brightwellii occurred at Plymouth from January to May, at Helder in April, and is not mentioned from the northern Atlantic.

Eucampia zodiacus was found abundantly at Helder in September and October, also at Plymouth in October, but not in the northern Atlantic.

Lithodesmium undulatum is very characteristic of the neritic plankton along the continental coast.

Rhizosolenia alata follows *R. styliformis* as a rule, and it may be assumed that it enters the North Sea both from the north and from the south.

R. calcar avis occurs usually in the company of *R. styliformis.*

R. robusta is an inhabitant of the eastern tropical Atlantic, west of Africa, and has never before been seen in the northern Atlantic. This remarkable species was found in September and October both at Plymouth and at Helder, in October between the Färöes and Iceland (Ostenfeld). It reached Hanstholm (Jutland) in the beginning of November and arrived off the Swedish coast at the end of the same month.

I give the following list of the species, which enter the North Sea through the English Channel. Species, marked *, may also arrive round Scotland.

Bacteriastrum varians.
Cerataulina Bergonii.
**Chætoceros curvisetus.*
C. densus.
C. didymus.
**C. Schüttii.*
Ditylum Brightwellii.
Eucampia zodiacus.
Guinardia flaccida.
Lithodesmium undulatum.
**Rhizosolenia alata.*
R. calcar avis.
R. robusta.
R. Shrubsolei.
R. Stoltherfothii.
**R. styliformis.*

It is worthy of remark, that the *chæto-plankton* already begins to appear in the autumn. *Chætoceros decipiens* was then found by Ostenfeld on the south side of Iceland and round Scotland. Is was not rare at Plymouth in the end of November and in the beginning of December.

II. Plankton of the Skagerak in 1897.

During the year 1897 samples were gathered two to four times in each month at Måseskär, in June, July and August on many different spots along the Swedish coast, in September on the route Vinga to Oxö in Norway, in October and November on several points in the Skagerak, and finally in December at some points in the Skagerak and in Gullmarfjord.

The animals in these collections, made from January to September, have been examined by Dr. C. Aurivillius, who has already published the results.[1] The samples gathered from September to the end of the year have been examined by me, also as regards the animals. An extensive amount of observations have thus been accumulated during the year 1897 and will be discussed in the following pages.

Ith Period. Jan. 4th—Febr. 8th. The collections from Måseskär prove that during this period the ruling plankton belonged to the *tricho-* and *tripos*-types. Animals are scarce. Among them we note the northern or arctic *Fritillaria borealis*, *Tintinnus denticulatus*, *Tintinnopsis ventricosa* and the euryhaline *Acartia longiremis*, *Centropages hamatus* and *Temora longicornis*. Some few specimens of the southern neritic plankton, as *Corycæus anglicus*, *Oithona similis*, *Paracalanus parvus* and *Sagitta bipunctata*, which are lingering remnats from the summer, disappear during March and April.

Of *dinoflagellates Ceratium tripos* and its associates in the tripos-plankton are not rare. The northern *Cerat. trip. var. longipes* is not rare.

Almost all *diatoms* are northern or arctic forms, as:

Biddulphia aurita r.
Chætoceros borealis var. Brightwellii + .
C. debilis + .
C. scolopendra r.
C. similis r.
Coscinodiscus oculus irdis + .
C. polychordus r.
Skeletonema costatum + .
Thalassiothrix Frauenfeldii c.
T. longissima c.

Among southern species we note some scarce specimens of *Guinardia flaccida.*

IInd Period. February 23^{d} to April 1th. This period is characterized by an increase of arctic forms and by the decrease of the tricho- and tripos-types. In the beginning of the March the chæto-plankton sets in.

Among the *arctic* and *northern* species we note as most characteristic the following:

Dinobryum pellucidum.
Chætoceros borealis var. Brigthwellii.
C. debilis.
C. diadema.
C. hiemalis.
C. socialis.
Chætoceros teres.
Coscinodiscus oculus iridis.
Nitzschia seriata.
Rhizosolenia obtusa.
R. semispina.
Thalassiothrix Nordenskiöldii.

[1] »Die Planktonfauna des Skageraks», K. Sv. Vet. Akad. Handl. Band 30. N:o 3. 1898.

The *chæto-plankton* is represented by *Chætoceros decipiens* and *Phæocystis Pouchetii*. As is seen from the report on the North Sea both the chætoplankton and the northern plankton entered the North Sea round the north of Scotland, the water with chætoplankton pushing before it that with arctic and northern forms, which could be traced to the south side of Iceland.

At the end of March a small amount of *southern neritic* plankton sets in, represented by rare specimens of *Cerataulina Bergonii*, *Chætoceros curvisetus* and *C. danicus*. Of these *Ch. curvisetus* rearches its maximum from the end of September.

IIIᵈ Period. April 8th to May 29th. This period is characterized by the gradual disappearence of the arctic and northern species as well as by the development of the southern neritic plankton and of the tripos-plankton. Still, some apparently northern species, as *Chætoceros constrictus*, *C. contortus* and *Leptocylindrus danicus*, reach their maximum during this epoch.

Of southern species *Acartia Clausii* was found as early as in the beginning of April, the following in the end of April and the beginning of May:

Oithona similis.
Evadne Nordmannii.
Podon Leuckartii.
Ceratium fusus.
Rhizosolenia gracillima.

IVth Period. June 19th to October 9th. The arctic and northern forms are now gone, almost completely, and the predominant plankton-types are the tripos-plankton and the southern neritic plankton.

In this period the following species occur more or less abundantly:

A. *From the end of May:*
Acartia Clausii rearches its maximum in the middle of August.
Oithona similis, common during the entire period.
Evadne Nordmannii, also common during the whole period.
Rhizosolenia gracillima, also common during the whole period.

B. *From the middle and end of June*:
Paracalanus parvus, the whole period.
Tintinnopsis campanula, the whole period.
Tintinnus subulatus rearches its maximum in August.

C. *From August:*
Oikopleura dioica, *Centropages typicus*, *Isias clavipes*, *Sagitta bipunctata* } reach their maximum at the end of the month.
Ceratium macroceros, *Peridinium divergens* } occur through the whole period.
Noctiluca miliaris has its maximum in September.

Chætoceros didymus } were found during the whole period.
C. Schüttii }

Rhizosolenia styliformis, whole of August, continues to the end of the year.

D. *From September:*

Calanus finmarchicus.	*Biddulphia mobilensis.*
**Corycæus anglicus.*	**Chætoceros densus.*
**Labidocera Wollastonii.*	**Rhizosolenia calcar avis.*
Evadne spinifera.	*R. semispina.*
Acanthometron quadrifolium.	*R. setigera.*
Ceratium tripos var. longipes.	*Stephanopyxis turgida.*

Those marked * arrived probably from the southern North Sea, the others with the Scottish current.

The following, euryhaline animals appeared more or less abundantly, especially in the fjords:

Acartia longiremis.
Centropages hamatus.
Pseudocalanus elongatus.
Temora longicornis.
Temorella affinis.

These may be considered either as coming with the outflowing Baltic water or as stationary in the fjords. The *Pseudocalanus* and *Temora* may however also have followed the Scottish current.

As stated above, the arctic and northern forms have almost completely disappeared. But an interesting exception occurred. Mr. Gunnar Andersson, who hauled in the middle of July south of Hven in Öresund, found there a surface stratum, containing *Acartia bifilosa A. longiremis*, *Temorella affinis*, *Aphanizomenon* and *Nodularia spumigena*, all Baltic forms, but below that stratum near the bottom (or about 40 metres from the surface) a plankton remarkably similar to that, which prevailed in the Skagerak in the spring. *Chætoceros borealis var. Brigthwellii*, abundant in the Skagerak in the winter 1896—97, was also very common in the bottom-plankton. There remained thus during the height of summer in Öresund, a remnant from the winter and the spring, below the outflowing Baltic water.

V^th^ Period. October 19th to the end of the year. Tripos- and southern neritic planktons now prevail as before, but, in addition, northern forms in the company of species from the Scottish current begin to arrive. The plankton becomes thus very complicated.

I consider that the following species belong to the southern neritic plankton:

Euterpe acutifrons, found first $^{19}/_{X}$.
Eucampia zodiacus, $^{19}/_{X}$.
Proto pedata, $^{25}/_{XI}$.
Rhizosolenia robusta, $^{25}/_{XI}$.
Bacteriastrum varians $^{21}/_{IX}$ in Skagerak, the $^{9}/_{IX}$ at Måseskär.
Tomopteris helgolandica, $^{4}/_{XII}$ (has possibly been carried by the Scottish current).

As transported by the scottish current I consider the following:

Pseudocalanus elongatus, $^{26}/_{X}$, (still uncertain whether partly indigenous in the Skagerak or arrived with the Scottish or Baltic currents.)

Plectophora arachnoides, $^{19}/_{X}$.

Halosphæra viridis, $^{19}/_{X}$.

Coscinodiscus concinnus, $^{19}/_{X}$.

Ceratium tripos var. bucephala, $^{8}/_{XI}$ in the Skagerak.

Lauderia annulata, $^{4}/_{XII}$.

Among northern forms, belonging the *northern neritic plankton* or to the arctic *sira-plankton*, I note the following:

A. *Found from the 9th or 19th of October:*

Cyttarocylis denticulata.
Dinophysis acuta.
Gonyaulax spinifera.
Chætoceros borealis.
C. constrictus.
C. contortus.
C. debilis.
Chætoceros diadema.
C. laciniosus.
Coscinodiscus oculus viridis.
Skeletonema costatum.
Thalassiosira gelatinosa.
Thalassiothrix longissima.

B. *Found from November:*

Thalassiothrix Frauenfeldii, $^{2}/_{XI}$.
Biddulphia aurita, $^{18}/_{XI}$.

C. *Found first in December:*

Ptychocyclis acuta.
P. obtusa.
Tintinnus secatus.

To sum up the above statements I formulate the plankton in the following manner:

Ith	Period	$^{4}/_{I}$ to $^{8}/_{II}$	Tp. T.
II^{d}	»	$^{23}/_{II}$ to $^{1}/_{IV}$	(Tp. T.) Si. C. Ns.
III^{d}	»	$^{8}/_{IV}$ to $^{29}/_{V}$	(C. Ns.) Tp. Nm.
IVth	»	A. $^{19}/_{VI}$ to the beginning of August .	Tp. Nm.
		B. From August to $^{9}/_{X}$	Tp. Nm. S.
Vth	»	$^{19}/_{X}$ to $^{23}/_{XII}$	(Tp. Nm. S.) Nc. Nh. Ns. T.

Of the above symbols Tp denotes tripos-plankton, T tricho-plankton, Si sira-plankton, C chæto-plankton, S styli-plankton, Nc and Nh plankton with *Coscinodiscus concinnus* and *Halosphæra*, Nm southern and Ns northern coast-plankton.

There is thus *on the whole* the same succession as has been found during the two preceding years.

Tables.

In order to restrict the bulk of the following tables, some rare forms have been omitted.

Species excluded from Table I.

Dinobryum pellucidum Lev.	$^{9}/_{V}$	57° 49′ N.	10° 43′ E.	+
	$^{28}/_{IV}$	57° 50′ N.	7° 13′ E.	r
Ceratium tripos var. bucephala Cl.	$^{1}/_{V}$	57° 17′ N.	8° 47′ E.	r
	$^{9}/_{V}$	57° 18′ N.	6° 15′ E.	r
	$^{27}/_{IV}$	58° 23′ N.	2° 44′ E.	r
	$^{25}/_{IV}$	56° 30′ N.	6° 31′ E.	r
Ceratium tripos v. horrida Cl.	$^{27}/_{IV}$	58° 23′ N.	2° 44′ E.	c
	$^{25}/_{IV}$	57° 53′ N.	6° 30′ W.	r
Dinophysis acuta Ehb.	$^{2}/_{V}$	56° 19′ N.	3° 52′ E.	r
Asterionella spathulifera Cl.	$^{9}/_{V}$	56° 44′ N.	2° 6′ E.	r
	$^{3}/_{V}$	55° 26′ N.	0° 40′ E.	r
Biddulphia aurita Lyngb.	$^{9}/_{V}$	57° 49′ N.	10° 43′ E.	r
	$^{2}/_{V}$	55° 29′ N.	7° 22′ E.	rr
B. mobilensis Bail.	$^{3}/_{V}$	54° 10′ N.	8° 9′ E.	r
	$^{26}/_{IV}$	58° 39′ N.	3° 41′ W.	+
	$^{25}/_{IV}$	57° 53′ N.	6° 30′ W.	r
Chætoceros contortus Schütt	$^{30}/_{IV}$	57° 49′ N.	10° 43′ E.	+
	$^{23}/_{V}$	57° 44′ N.	10° 23′ E.	r
	$^{28}/_{IV}$	57° 50′ N.	7° 13′ E.	+
C. criophilus Castr.	$^{28}/_{IV}$	57° 50′ N.	7° 13′ E.	r
	$^{26}/_{IV}$	58° 39′ N.	3° 41′ W.	r
C. curvisetus Cl.	$^{1}/_{V}$	56° 50′ N.	6° 18′ E.	r
	$^{2}/_{V}$	56° 19′ N.	3° 52′ E.	cc
C. (borealis?) densus Cl.	$^{1}/_{V}$	56° 50′ N.	6° 18′ E.	r
	$^{2}/_{V}$	55° 29′ N.	7° 22′ E.	r
C. hiemalis Cl	$^{30}/_{IV}$	57° 49′ N.	10° 43′ E.	r
	$^{1}/_{V}$	57° 8′ N.	7° 51′ E.	r
	$^{28}/_{IV}$	57° 50′ N.	7° 13′ E.	r
C. laciniosus Schütt	$^{26}/_{IV}$	58° 39′ N.	3° 41′ W.	+
C. socialis Lauder	$^{9}/_{V}$	57° 18′ N.	6° 15′ E.	r
Corethron hystrix Hensen	$^{26}/_{IV}$	58° 39′ N.	3° 41′ W.	r
Coscinodiscus polychordus Gran.	$^{26}/_{IV}$	»	»	+
Eucampania zodiacus Ehb.	$^{1}/_{V}$	57° 17′ N.	8° 47′ E.	r
	$^{15}/_{V}$	54° 33′ N.	6° 47′ E.	r
	$^{3}/_{V}$	55° 26′ N.	0° 40′ E.	r
Leptocylindrus danicus Cl.	$^{30}/_{IV}$	57° 49′ N.	10° 43′ E.	r
	$^{28}/_{IV}$	57° 50′ N.	7° 13′ E.	r
Rhizosolenia setigera Btw.	$^{28}/_{IV}$	57° 50′ N.	7° 13′ E.	r

R. Stolterfothii H. P.	$^{1}/_{V}$	56° 44′ N.	2° 34′ E.	r
Thalassiothrix Frauenfeldii Grun.	$^{30}/_{IV}$	57° 49′ N.	10 43′ E.	r
	$^{23}/_{V}$	57° 44′ N.	10° 23′ E.	r
	$^{28}/_{IV}$	57° 50′ N.	7° 13′ E.	r
Halosphæra viridis Schmit.	$^{2}/_{V}$	55° 29′ N.	7° 22′ E.	r

Species excluded from Table III.

Ceratium tripos var. horrida Cl.	$^{31}/_{X}$	56° 12′ N.	2° 29′ W.	r
Diplopsalis lenticula Bergh.	$^{29}/_{X}$	57° 43′ N.	10° 20′ E.	r
Xanthidium multispinosum Moeb.	$^{30}/_{X}$	57° 9′ N.	5° E.	r
Distephanus speculum Ehb.	$^{8}/_{XI}$	57° 43′ N.	10° 59′ E.	r
	$^{29}/_{X}$	57° 43′ N.	10° 20′ E.	r
	$^{30}/_{X}$	55° 42′ N.	6° 52′ E.	r
Bacteriastrum varians Lauder	$^{29}/_{X}$	57° 44′ N.	9° 35′ E.	r
	$^{31}/_{X}$	52° 7′ N.	3° 41′ E.	+
Cerataulina Bergonii H. P.	$^{29}/_{X}$	57° 40′ N.	11° 30′ E.	r
	$^{31}/_{X}$	52° 7′ N.	3 41′ E.	r
Chætoceros constrictus Gran.	$^{29}/_{X}$	57° 40′ N.	11° 30′ E.	r
	$^{29}/_{X}$	57° 50′ N.	11° 31′ E.	+
C. contortus Schütt	$^{29}/_{X}$	57° 40′ N.	11° 30′ E.	c
	$^{8}/_{XI}$	57° 43′ N.	10° 59′ E.	+
C. criophilus Castr.	$^{22}/_{XI}$	58° 9′ N.	3° 55′ W.	r
C. danicus Cl.	$^{29}/_{X}$	57° 50′ N.	11° E.	r
	$^{31}/_{XI}$	55° 27′ N.	0 31′ E.	r
C. (borealis var.?) densus Cl.	$^{7}/_{XI}$	55 55′ N.	7° 36′ E.	r
	$^{31}/_{X}$	52° 7′ N.	3° 41′ E.	r
C. scolopendra Cl.	$^{29}/_{X}$	57° 50′ N.	11 E.	r
Coscinodiscus excentricus Ehb.	$^{31}/_{X}$	52° 7′ N.	3° 41′ E.	+
Eucampia zodiacus Ehb.	$^{29}/_{X}$	57° 43′ N.	10° 20′ E.	r
	$^{31}/_{X}$	52° 7′ N.	3° 41′ E.	c
Leptocylindrus danicus Cl.	$^{29}/_{X}$	57° 43′ N.	10° 20′ E.	r
Lithodesmium undulatum Btw.	$^{7}/_{XI}$	57° 5′ N.	8° 28′ E.	rr
Rhizosolenia setigera Btw.	$^{29}/_{X}$	57° 50′ N.	11° E.	r
	$^{29}/_{X}$	57° 43′ N.	10° 20′ E.	r
Streptotheca thamesis Shrubs.	$^{13}/_{XI}$	55° 55′ N.	6° 8′ W.	+
Thalassiothrix longissima Cl. & Grun.	$^{29}/_{X}$	57° 50′ N.	11 E.	r
	$^{29}/_{X}$	57° 43′ N.	10° 59′ E.	+
	$^{11}/_{XI}$	58° 28′ N.	0° 6′ W.	r

Species excluded from Table IV.

Acartia longiremis Lilljeb. $^{3}/_{VII}$ +.
Paracalanus parvus Claus $^{23}/_{VII}$ +.
Evadne Nordmannii Lovén $^{3}/_{VII}$ r.
Podon polyphemoides Leuck. $^{3}/_{VII}$, $^{7}/_{VII}$ r.
Anuræa aculeata Ehb. $^{3}/_{IV}$ c.[1]
Cyttarocylis Claparèdii v. Dad. $^{5}/_{VIII}$, $^{3}/_{IX}$ r.

[1] Determination by Dr. L. Jägerskiöld.

Ptychocylis Markusowskyi v. Dad. $^{3}/_{IX}$, $^{9}/_{IX}$ r.
Tintinnopsis ventricosa Clap. & Lachm. $^{3}/_{VII}$ r.
Bellerochea malleus Btw. $^{3}/_{VII}$, $^{7}/_{VII}$ r.
Chætoceros debilis Cl. $^{9}/_{IV}$ +, $^{26}/_{VI}$ r.
Lauderia annulata Cl. $^{26}/_{VI}$ r.
Thalassiosira gelatinosa Hensen $^{22}/_{IV}$, $^{14}/_{V}$ r.
T. Nordenskiöldii Cl. $^{9}/_{IV}$ r.

Species excluded from the table V.

Ceratium lineatum Ehb. $^{23}/_{II}$, $^{20}/_{XI}$ r.
C. macroceros Ehb. $^{10}/_{VIII}$ +.
Dinophysis homunculus Stein $^{30}/_{VII}$, $^{17}/_{VIII}$ r.
Phyrophacus horologium Stein $^{7}/_{VIII}$, $^{23}/_{VIII}$ r.
Chætoceros criophilus Castr. $^{7}/_{IV}$ r.
Lithodesmium undulatum Ehb. $^{6}/_{X}$ r.
Navicula membranacea Cl. $^{23}/_{VII}$, $^{20}/_{XI}$ r.
Rhizosolenia alata var. corpulenta Cl. $^{23}/_{VIII}$ r.
Thalassiothrix Frauenfeldii Grun. $^{5}/_{II}$ r.

Species excluded from the table VI.

Proto pedata Leach. $^{25}/_{XI}$, $^{4}/_{XII}$ r, $^{23}/_{XII}$ +.
Acartia bifilosa Giesbr. $^{29}/_{VI}$ rr.
Calanus finmarchicus Gunn. $^{16}/_{III}$, $^{22}/_{III}$ r.
Labidocera Wollastonii Lubb. $^{28}/_{IX}$ rr.
Temorella affinis Poppe $^{22}/_{III}$ rr.
Podon intermedius Lilljeb. $^{20}/_{IX}$ r.
Tomopteris helgolandica Greff. $^{4}/_{XII}$ rr.
Synchæta baltica Ehb. $^{14}/_{V}$ +.
Cyttarocylis Claparedii v. Dad. $^{26}/_{VI}$, $^{10}/_{VII}$ +.
Ptychocylis obtusa Brandt $^{17}/_{XII}$ +.
P. acuta Brandt $^{13}/_{I}$, $^{26}/_{I}$, $^{23}/_{II}$ r.
Tintinnopsis ventricosa Clap. & Lachm. $^{8}/_{II}$, $^{5}/_{V}$, $^{11}/_{IX}$ r.
Tintinnus secatus Brandt $^{4}/_{XII}$ r.
Dinobryum pellucidum Lev. $^{22}/_{III}$, $^{22}/_{IV}$, $^{22}/_{V}$ +.
Phæocystis Pouchetii Lagh. $^{16}/_{III}$, $^{1}/_{IV}$ +.
Ceratium tripos v. bucephala Cl. $^{25}/_{XI}$, $^{4-23}/_{XII}$ r.
Peridinium ovatum Pouch. $^{22}/_{IV}$, $^{14}/_{V}$ rr.
Xanthidium multispinosum Moeb. $^{11}/_{IX}$, $^{19}/_{X}$, $^{26}/_{X}$ r.
Bacteriastrum varians Lauder $^{11}/_{IX}$ r.
Chætoceros coronatus Gran $^{11}/_{IX}$ r.
C. Granii Cl. NSp. $^{23}/_{III}$ c.
C. similis Cl. $^{4}/_{I}$, $^{13}/_{I}$, $^{2}/_{III}$ r.
Coscinodiscus polychordos Gran $^{4}/_{I}$, $^{13}/_{I}$, $^{4}/_{IV}$, $^{19}/_{X}$ r.
C. stellaris Roper $^{26}/_{I}$, $^{19}/_{X}$ r.
Lauderia annulata $^{4}/_{XII}$ r.
Nitzschia delicatissima Cl. $^{8}/_{II}$ r.
Rhizosolenia robusta Btw. $^{25}/_{XI}$ r.
Stephanopyxis turgida Grev. $^{4}/_{XII}$.
Thalassiosira gelatinosa Hensen $^{9}/_{X}$, $^{26}/_{X}$ r.

Table I. North Sea

Month	4	5	5	5	5	5	5	5	5	5	5	5
Day	30	9	1	23	10	1	3	2	1	3	2	15
Lat. N.	57° 49	57° 49′	57° 49′	57° 44′	57° 40′	57° 17′	54° 10′	56° 41′	57° 8′	54° 49′	55° 29′	56 4′
Long.	10° 43′ E.	10° 34′ E	10° 22′ E.	10° 23′ E.	9° 8′ E.	8° 47′ E.	8° 9′ E.	7° 56′ E.	7° 51′ E.	7° 39′ E.	7° 22′ E.	7° 20′ E.
Temp.	6,3	—	6,4	11	7	6,5	8,8	7,1	5,5	8,1	6,8	7,5
Sal.	32,84	—	33,28	28,67	32,32	33,81	28,03	32,63	34,76	30,41	33,20	34,14
Animals not examined	+	+	+	+	+	+	+	+	r	c	+	c
Phæocystis Pouchetii Lagh.	—	—	—	—	—	—	—	—	—	—	—	—
Ceratium furca Duj.	—	—	—	r	r	r	—	—	+	—	—	—
C. fusus Duj.	—	+	+	—	+	c	+	c	+	r	+	—
C. tripos Nitzsch.	r	r	+	c	r	c	+	c	+	c	+	—
var. longipes Bail.	r	c	c	c	cc	+	—	—	—	+	+	—
var. macroceros Ehb.	—	—	—	r	—	—	—	r	—	—	+	—
Peridinium depressum Bail.	—	c	+	—	+	r	r	+	—	+	r	—
Cerataulina Bergonii H. P.	r	—	—	—	—	—	—	—	—	—		—
Chætoceros atlanticus Cl.	—	—	—	—	—	—	—	—	—	—		—
C. borealis Btw.	+	+	r	—	+	+	—	—	+	—	r	—
var. Brightwellii Cl.	c	—	r	cc	c	+	—	—	—	—	+	—
C. constrictus Gran	c	—	—	+	—	—	—	—	—	—	—	—
C. debilis Cl.	—	—	—	—	—	—	—	—	c	—	—	—
C. decipiens Cl.	c	+	—	+	+	—	—	—	c	—	—	—
C. diadema Ehb.	+	—	—	—	—	—	—	—	—	—	—	—
C. didymus Ehb.	—	—	—	c	—	—	—	—	—	—	—	—
C. scolopendra Cl.	—	—	—	—	—	—	—	—	—	—	—	—
C. teres Cl.	r	—	—	—	—	r	—	—	—	—	—	—
Coscinodiscus concinnus W. Sm.	—	—	—	—	r	—	—	—	—	—	rr	—
C. oculus iridis Ehb.	—	—	—	—	—	—	—	—	—	—	—	—
Guinardia flaccida Castr.	—	—	—	—	—	r	—	—	r	—	—	—
Lauderia annulata Cl.	—	—	—	—	—	—	—	—	—	—	—	—
Nitzschia seriata Cl.	—	—	—	—	—	—	—	—	r	—	—	—
Rhizosolenia gracillima Cl.	r	—	—	c	—	—	—	—	—	—	—	—
R. obtusa Hensen	r	—	—	r	—	—	—	—	r	—	—	—
R. semispina Hensen	r	r	—	—	—	+	—	—	—	—	—	—
R. Shrubsolei Cl.	—	—	—	—	—	—	—	—	r	—	—	—
R. styliformis Btw.	—	—	r	—	—	r	—	—	—	—	rr	rr
Thalassiosira gravida Cl.	—	—	—	—	—	—	—	—	—	—	—	—
T. Nordenskiöldi Cl.	—	—	—	—	—	r	—	—	+	—	—	—
Thalassiothrix longissima Cl. & Grun.	—	r	—	r	r	—	—	—	—	—	—	—
Planktontype	C. T.	Ns. C.	Ns.	{Ns.(Nm.) / T. Tp.}	Ns.	Tp. Ns.	(Tp.)	Tp. Ns.	C. Ns. Si.	Tp. (Ns.)	Tp. Ns.	?

April—May 1897.

5	4	5	5	5	5	5	5	4	5	5	5	5	4	4	4	4
22	28	9	1	22	15	2	21	27	1	9	8	3	26	26	25	25
56° 12′	57° 50′	57° 18′	56° 50′	55°	54° 33′	56° 19′	52° 13′	58° 23′	56° 44′	56° 44′	55° 51′	55° 26′	58° 30′	58° 39′	57° 53′	56° 30′
7° 19′ E.	7° 13′ E.	6° 15′ E.	6° 18′ E.	6° 13′ E.	6° 47′ E.	3° 52′ E.	3° 35′ E.	2° 44′ E.	2° 34′ E.	2° 6′ E.	1° 29′ E.	0° 40′ E.	0° 43′ W.	3° 41′ W.	6° 30′ W.	6° 31′ W.
11	5,5	7	6,5	10	7,5	7	11	5,6	6,3	6,5	—	7,5	7,1	6,4	7,3	7,2
32,65	28,50	35,05	34,76	34,09	34,79	35,17	33,68	35,03	35,20	35,20	—	35,08	35,29	34,74	34,55	34,26
c	r	r	+	c	c	+	+	r	r	r	c	c	c	r	c	o
—	—	—	—	—	—	r	c	—	c	c	cc	+	—	—	—	—
r	—	r	c	—	+	r	—	—	—	r	—	r	—	—	r	—
r	—	—	+	—	+	r	—	—	r	r	—	r	—	—	r	—
cc	r	r	+	+	+	—	—	—	r	r	—	—	—	—	—	r
r	—	+	c	—	+	r	—	+	c	+	+	r	—	r	—	r
r	—	r	—	—	+	r	—	r	—	r	—	r	r	r	—	—
c	—	+	+	—	—	—	—	—	r	—	r	r	—	—	—	—
—	r	r	—	—	—	r	—	—	—	—	—	r	—	—	—	—
—	—	+	—	—	—	—	—	—	r	—	+	—	—	—	—	—
—	c	—	—	—	—	—	—	+	r	+	—	—	+	r	—	—
—	+	c	—	—	c	—	—	—	r	+	—	—	—	—	—	—
—	cc	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	c	—	—	—	cc	—	—	r	+	+	—	—	c	—	—
—	+	cc	+	—	—	r	—	cc	cc	c	c	c	c	c	r	r
—	+	—	—	—	—	c	—	—	r	r	—	—	—	+	r	—
—	—	—	—	—	r	r	—	—	—	—	—	—	—	r	—	—
—	r	r	—	—	—	—	—	r	r	r	—	—	—	—	—	—
—	r	r	—	—	—	—	—	—	r	r	—	—	—	—	—	—
rr	—	—	r	—	r	—	—	—	—	—	—	—	—	r	r	—
—	—	—	—	—	—	—	—	+	—	—	—	—	—	r	r	+
—	—	—	—	—	r	r	—	—	+	r	—	r	—	—	—	—
—	—	—	—	—	—	c	—	—	c	+	r	+	—	—	—	—
—	r	r	—	—	—	r	—	—	—	—	—	—	—	c	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	r	r	—	—	—	—	—	—	—	—	—	—	—	—	r	—
—	—	—	r	—	c	r	—	—	+	+	r	c	—	+	+	r
—	—	—	—	—	—	—	—	—	r	r	—	c	—	—	—	—
—	—	—	—	—	+	—	—	—	r	r	r	r	+	+	c	—
—	—	—	—	—	—	+	—	—	+	+	—	+	—	+	—	—
—	—	c	—	—	—	cc	—	—	c	r	—	c	—	c	—	+
—	—	—	—	—	—	r	—	—	r	+	r	r	—	—	—	—
Tp. (Ns.)	C.	C. Ns. Si.	Ns. Tp.	Tp.	Tp. Ns. T.	Si. Ns.	C.	C.	C. Ns. Si.	C. Ns.	C. Ns.	C. Si. Ns.	C. (S.)	Si. C. (S.)	S.	

Table II. North Sea

Month	7	7	8	8	8	8	8	8	7	8
Day	30	31	1	1	1	1	1	1	31	1
Lat. N.	57° 50′	57° 44′	57° 42′	57° 15′	57° 29′	57° 14′	54° 30′	55° 29′	55° 53′	56° 51′
Long.	11° E.	10° 38′ E.	10° 34′ E.	9° 50′ E.	9° 2′ E.	8° 42′ E.	7° 49′ E.	7° 22′ E.	7° 1′ E.	7° 2′ E.
Temp.	19,75	18	19,5	17	18,5	17,5	17,3	17	17	17
Sal.	23,58	32,55	23,51	33,03	33,16	33,04	31,60	32,17	33,30	33,92
Animals not examined	c	+	+	c	cc	c	c	c	+	cc
Ceratium furca Duj.	—	—	—	—	—	—	r	—	—	—
C. fusus Duj.	—	—	—	—	—	—	r	—	—	—
C. tripos Nitzsch	—	r	+	+	+	—	+	c	+	c
var. longipes Bail	—	r	—	—	—	—	—	—	—	—
var. macroceros Ehb.	—	+	cc	cc	cc	c	c	+	—	+
Peridinium divergens Ehb.	—	—	—	—	—	—	—	—	—	—
Bacteriastrum varians Lauder	—	—	—	+	r	c	r	—	—	—
Chætoceros curvisetus Cl.	cc	+	—	—	—	—	—	—	—	
C. (borealis var.?) densus Cl.	r	—	—	—	r	+	+	—	—	—
C. didymus Ehb.	c	+	—	—	—	—	—	—	—	—
C. Schüttii Cl.	+	c	—	—	—	—	—	—	—	—
C. Weissflogii Schütt	—	—	—	—	—	r	—	—	—	—
Coscinodiscus concinnus W. Sm.	—	—	—	—	—	—	r	—	—	—
Guinardia flaccida Castr.	r	—	r	—	—	—	r	c	—	—
Rhizosolenia gracillima Cl.	r	r	—	—	—	—	—	—	—	—
R. semispina Hensen	—	—	—	—	—	—	r	—	—	—
R. Shrubsolei Cl.	r	—	—	—	—	—	c	—	—	—
R. Stolterfothii H. P.	—	—	—	—	—	—	c	—	—	—
R. styliformis Btw.	—	—	—	c	+	c	cc	—	—	—
Planktontype	Nm.	Nm. Tp.	Tp.	Tp. S.	Tp. S.	S. Nm. Tp.	S. Nm. Tp.	Nm. Tp.	(Tp.)	Tp.

July—August 1897.

8	7	7	7	7	7	7	7	7	7	8	8	7	8	8
7	31	31	31	31	31	30	31	30	31	1	8	30	7	13
57° 19′	57° 23′	54° 30′	56° 14′	57° 8′	53° 56′	52° 37′	53° 18′	52° 41′	55° 50′	56° 37′	56° 25′	55° 18′	56° 29′	56° 12′
6° 42′ E.	6° 5′ E.	5° 44′ E.	4° 16′ E.	4° 6′ E.	4° 2′ E.	4° E.	3° 12′ E.	2° 29′ E.	2° 1′ E.	0° 30′ E.	0° 12′ E.	0° 13′ W.	0° 14′ W.	1° 30′ W.
17,5	16	16	15	15,75	15,5	18	15	14,5	15,2	14,5	16.5	15,5	16	15,5
31,22	32,56	34,55	35,15	34,79	34,64	33,46	34,41	34,26	35,18	35,10	34,96	34,88	34,91	34,84
+	c	r	cc	c	c	r	+	cc	cc	c	r	c	c	+
—	—	—	—	—	—	—	r	—	r	r	r	r	r	+
—	—	—	—	r	—	—	+	—	—	r	r	r	+	+
+	r	c	cc	c	+	—	+	r	+	+	+	r	r	+
—	—	—	c	—	—	—	c	—	—	—	—	—	—	—
+	c	+	—	c	+	+	+	—	+	c	cc	cc	r	+
—	—	—	—	r	—	—	r	—	r	r	—	—	r	—
—	—	—	—	—	—	—		—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	r	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	r	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	+	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	rr	—	—	—	—	—	—	—
(Tp.)	Tp.	Tp.	Tp. Ns.	Tp.	Tp.	Nm. Tp.	Ns. Tp.	?	Tp.	Tp.	Tp.	Tp.	(Tp.)	Tp.

Table III. North Sea

Month	10	10	11	10	10	11	10	10	10	10	11	10	10
Day	29	29	8	29	29	7	30	31	30	30	7	30	30
Lat. N.	57° 40′	57° 50′	57° 43′	57° 43′	57° 44′	57° 5′	57° 9′	55°	56° 15′	56° 28′	55° 55′	55° 42′	54° 49′
Long.	11° 30′ E.	11° E.	10° 59′ E.	10° 20′ E.	9° 35′ E.	8° 28′ E.	8° 8′ E.	7° 59′ E.	7° 45′ E.	7° 42′ E.	7° 36′ E.	6° 52′ E.	6° 4′ E.
Temp.	9,3	10	7,2	11,5	9,7	10,2	10,8	11,4	10,7	12	11	12,5	12,5
Sal.	21,81	23,16	19,08	29,88	32,56	33,52	33,66	31,51	32,48	32,41	32,82	34,16	32,9
Animals not examined	+	+	+	+	—	+	—	c	—	—	c	+	c
Ceratium furca Duj.	—	r	r	r	r	+	—	r	r	+	r	+	+
C. fusus Duj.	r	r	r	r	r	c	—	—	r	+	r	+	+
C. tripos Nitzsch	c	c	c	+	r	c	+	c	c	c	+	+	c
var. bucephala Cl.	—	—	r	—	—	r	r	—	—	—	—	—	—
var. longipes Bail	+	r	r	—	—	—	—	—	—	—	—	—	r
var. macroceros Ehb.	c	c	r	c	cc	c	cc	c	cc	c	cc	+	—
Dinophysis acuta Ehb.	—	—	—	r	—	—	—	—	—	r	—	—	r
Peridinium divergens Ehb.	r	—	—	r	r	—	—	—	—	—	—	—	—
Pyrophacus horologium	—	—	—	—	—	—	—	—	—	—	—	r	r
Biddulphia mobilensis Bail.	—	—	r	—	—	—	—	—	—	—	r	—	r
Chætoceros borealis Btw.	r	+	—	+	—	—	—	—	—	—	—	—	—
var. Brightwellii Cl.	—	r	rr	r	r	—	—	—	—	—	—	—	—
C. curvisetus Cl.	c	cc	cc	c	—	—	—	—	—	—	—	—	—
C. decipiens Cl.	—	r	—	r	—	—	—	—	—	—	—	—	—
C. didymus Ehb.	c	c	c	c	—	—	—	—	—	—	—	r	—
C. Schüttii Cl.	c	cc	c	r	—	—	—	—	—	—	—	r	—
Coscinodiscus concinnus W. Sm.	—	r	—	—	—	r	—	+	r	r	+	—	—
C. oculus iridis Ehb.	—	—	—	—	—	r	—	—	—	—	r	—	—
Ditylum Brightwellii Wert.	r	+	r	+	—	r	—	—	—	—	r	—	r
Guinardia flaccida Castr.	—	r	—	—	—	—	—	—	—	r	r	—	—
Rhizosolenia alata Btw.	—	+	—	—	—	rr	—	—	—	—	—	—	—
R. calcar avis Schulz	—	r	—	r	—	rr	—	r	—	r	+	—	—
R. gracillima Cl.	c	+	+	+	—	—	—	—	—	—	—	—	—
R. robusta Norm.	—	—	—	—	—	rr	—	r	—	—	—	—	—
R. semispina Hensen	—	r	r	r	—	—	—	—	—	—	—	—	—
R. Shrubsolei Cl.	—	r	—	r	—	—	—	—	—	—	—	—	—
R. Stolterfothii H. P.	—	—	—	—	—	rr	—	—	—	—	—	—	—
R. styliformis Btw.	—	—	r	—	r	+	—	cc	r	r	c	—	r
Stephanopyxis turgida Guv.	—	—	—	—	—	—	—	r	—	—	r	—	—
Halosphæra viridis Schmitz	—	—	—	—	r	r	—	—	—	—	—	—	+
Planktontype	Nm. Ns. Tp.	Nm. Ns. Tp.	Nm. Tp.	Nm. (Ns.) Tp.	Tp.	Tp. S.	Tp.	S. Tp.	Tp.	Tp.	Tp. S.	Tp.	Tp.

October—November 1897.

10	10	10	10	10	10	10	11	11	11	10	11	11	11	11	11	11
30	30	31	31	31	30	31	11	1	11	31	12	22	12	22	13	13
56° 33′	57° 9′	53° 12′	52° 7′	55° 58′	56° 36′	55° 27′	58° 28′	55° 2′	58° 18′	56° 12′	58° 55′	58° 9′	58° 40′	58° 3′	57° 8′	55° 55′
5° 21′ E.	5° E.	4° 21′ E.	3° 41′ E.	2° 41′ E.	1° 20′ E.	0° 31′ E.	0° 6′ W.	1° 15′ W.	2° W.	2° 29′ W.	3° 27′ W.	3° 55′ W.	4° 48′ W.	5° 14′ W.	5° 46′ W.	6° 8′ W.
11,4	11	12	13	10,6	10,9	10,4	10,5	—	11	11,3	11,5	—	11,5	—	12	11,5
34,88	33,85	33,66	34,07	35,12	35,17	34,96	35,25	34,50	35,22	34,33	34,94	—	34,76	—	34,24	34,04
c	+	c	+	r	+	+	+	+	c	c	+	r	c	—	r	—
—	r	+	—	+	r	c	r	+	+	r	—	—	—	+	—	—
—	+	r	+	cc	—	c	+	c	—	r	—	r	—	+	—	—
c	—	+	—	cc	c	c	—	+	+	c	—	c	r	+	r	+
—	—	—	—	—	r	—	—	r	c	—	—	c	—	c	—	r
—	—	c	c	—	r	—	—	—	r	—	—	—	r	—	—	—
—	cc	—	—	r	cc	c	c	cc	c	c	+	+	+	c	—	—
r	r	—	—	r	—	r	—	r	—	—	—	—	—	—	—	—
r	r	—	—	r	r	r	—	r	r	—	—	—	r	—	—	—
r	—	—	—	r	—	r	—	r	—	—	—	—	—	—	—	—
—	—	+	c	—	—	—	+	—	—	—	—	—	r	—	r	r
—	—	—	—	—	—	—	—	—	—	—	—	r	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	r	—	—	—	—	—	r	—	—	—
—	—	—	—	—	r	r	+	—	r	—	r	r	+	—	r	+
—	—	—	—	—		—	r	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	c	—	r	—	—	—	—	—	r	+
r	—	r	r	—	—	—	+	—	—	—	—	—	—	—	—	+
—	—	—	—	—	—	—	c	—	r	—	r	—	+	—	—	—
+	—	—	c	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	r	r	—	—	—	—	—	—	—	—	—	—	—	—	—
r	—	—	—	—	r	r	—	—	r	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	r	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	r	—	—	—	r	r	—	—	—	—	—	—	—	—	—	—
r	—	+	c	—	—	—	—	—	—	—	—	—	—	—	—	+
r	—	—	—	—	—	—	c	—	c	—	—	—	—	—	—	—
r	—	—	—	—	r	—	—	—	—	—	—	—	—	—	—	—
r	—	r	—	—	r	—	+	—	+	—	+	c	r	+	r	c
Tp. (Nm.)	Tp.	{Ns. Tp. Nm.}	Nm. Ns.	Tp.	Tp.	Tp.	Tp. S.	Tp.	Tp. S.	Tp.	Tp.	Tp.	(Tp.)	Tp.	?	Tp. (C.)

Table IV.

Month	4	4	4	4	5	5	5	5	6	6	6
Day	3	9	22	29	7	14	20	26	13	19	26
Temp.	5,9	7,2	9,4	10,6	10,1	9,4	13,7	12,7	17,2	14,3	17,2
Areom D.	1,0229	1,0237	1,0224	1,0236	1,0239	1,0238	1,0226	1,0245	1,0238	1,0232	1,0222
Wind	E.N.E.	S.W.	S.W.	S.W.	W.N.W.	W.S.W.	N.E.	S.W.	S.W.	N.W.	N.E.
Tide	Ebb.	Ebb.	Flood.	Flood.	Ebb.	Flood.	Ebb.	Flood.	Flood.	Flood.	Flood
Oikopleura dioica Fol.	—	—	—	—	—	—	—	—	—	—	+
Acartia Clausii Giesbr.	—	—	—	—	—	—	—	—	—	—	+
Centropages hamatus Lilljeb.	—	—	—	—	—	—	—	—	—	—	c
Euterpe acutifrons Dam.	—	—	—	—	—	—	—	—	—	—	—
Oithona similis Claus	—	—	—	—	—	—	—	—	—	—	—
Pseudocalanus elongatus Boeck	—	—	—	—	—	—	—	—	—	—	—
Temora longicornis O. E. Müll.	—	—	—	—	—	—	—	—	—	—	r
Noctiluca miliaris Suriray	—	—	—	—	—	—	—	—	—	—	—
Ptychocylis Ehrenbergii Clap. & Lachm.	—	—	—	—	—	—	—	—	—	—	—
Tintinnopsis heroidea v. acuminata v. Dad.	—	—	—	—	—	—	—	—	—	—	—
T. campanula Ehb.	—	—	—	—	—	—	—	—	—	rr	—
T. Labiancoi v. Dad.	—	—	—	—	—	—	—	—	—	rr	—
Tintinnus subulatus Ehb.	—	—	—	—	—	—	—	—	—	—	—
Phæocystis Pouchetii Lagh.	—	r	—	ccc	ccc	cc	ccc	ccc	ccc	—	—
Ceratium fusus Duj.	—	—	—	—	—	—	—	—	—	—	—
C. trip. v. longipes Bail.	—	—	—	—	—	—	—	—	—	—	—
Diplopsalis lenticula Bergh	—	—	—	—	—	—	—	—	—	—	—
Peridinium divergens Ehb.	—	—	—	—	—	—	—	—	—	—	r
Pyrophacus horologium Stein	—	—	—	—	—	—	—	—	—	—	r
Asterionella spathulifera Cl.	r	+	r	—	—	—	—	—	—	—	—
Bacteriastrum varians Lauder	—	—	—	—	—	—	—	—	—	—	—
Biddulphia aurita Lyngb.	cc	c	—	—	—	—	—	—	—	—	—
B. mobilensis Bail.	—	r	—	—	—	—	—	—	—	r	r
Cerataulina Bergonii H. Per.	—	r	c	r	cc	r	—	—	r	r	r
Chætoceros contortus Schütt.	—	—	—	—	—	—	—	—	—	—	r
C. curvisetus Cl.	—	—	—	—	—	—	—	—	—	—	—
C. danicus Cl.	—	—	—	—	—	—	—	—	—	—	—
C. decipiens Cl.	—	r	r	—	—	—	—	—	—	r	r
C. (borealis var.?) densus Cl.	—	—	—	—	—	—	—	—	r	—	r
C. didymus Ehb.	—	—	—	—	—	—	—	—	—	—	—
C. Schüttii Cl.	—	—	—	—	—	—	—	—	—	—	—
Coscinodiscus concinnus W. Sm.	—	—	—	—	—	—	—	—	—	—	r
C. excentricus Ehb.	—	—	+	—	—	—	—	—	—	—	r
C. oculus iridis Ehb.	—	—	r	—	—	—	—	—	—	r	r
Ditylum Brightwellii West.	r	r	+	—	—	—	—	—	—	—	—

Helder 1897.

7	7	7	7	7	8	8	8	9	9	9	9	9	10	10	11	12
3	7	14	23	29	5	12	28	3	9	15	22	29	21	28	12	8
17	15,6	18,1	17,2	18,5	21	19,6	18	17,1	14,6	15,4	14,2	15,7	11,4	11	8	6,8
1,0229	1,0240	1,0230	1,0246	1,0225	1,0214	1,0226	1,0225	1,0230	1,0235	1,0230	1,0252	1,0223	1,0233	1,0255	1,0263	1,0256
W.	W.S.W.	N.E.	N.W.	S.W.	E.S.E.	W.	S.W.	W.S.W.	N.	E.	W.	S.E.	N.E.	S.E.	S.S.W.	S.W.
Ebb.	Ebb.	Ebb.	Flood.	Ebb.	Ebb.	Flood.	Flood.	Ebb.	Flood.	Ebb.	Flood.	Ebb.	Flood.	Ebb.	Ebb.	Flood.
c	c	+	—	r	—	—	—	—	—	r	—	—	—	—	—	—
—	r	+	—	—	—	—	—	—	—	—	—	—	—	—	—	—
+	+	+	c	—	—	—	r	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	c	r	+	—
+	+	r	+	r	—	+	+	c	+	r	+	—	c	—	+	—
+	—	+	—	r	—	—	—	—	—	—	—	—	—	—	—	—
r	+	—	+	—	+	—	r	—	—	—	—	—	—	—	—	—
+	c	r	c	+	—	+	—	+	cc	—	c	—	r	—	—	—
—	—	—	r	r	r	r	—	—	r	—	r	—	r	—	—	—
—	—	—	—	—	r	r	—	—	—	—	r	—	+	—	—	r
—	—	—	—	+	+	+	+	+	r	—	r	r	+	—	—	—
—	—	—	rr	r	—	—	r	—	—	—	—	—	—	—	—	—
—	—	—	—	—	r	—	—	—	—	—	—	—	r	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	r	r	+	—	—	r	r	r	r	r	—
—	—	—	—	—	—	—	—	—	—	—	—	—	r	r	c	r
r	—	—	—	—	r	—	—	—	—	—	—	—	—	—	r	—
r	—	—	—	r	r	r	—	—	—	—	r	—	—	—	—	—
—	—	—	r	—	—	—	—	—	—	—	—	r	—	—	—	—
r	—	—	—	r	—	—	—	—	—	—	—	—	—	—	—	—
—	r	—	—	r	r	r	—	+	c	+	+	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
r	r	—	r	—	—	—	—	+	c	+	+	c	r	+	c	—
+	r	r	—	r	r	—	—	—	—	—	—	—	r	—	—	—
r	—	—	—	—	—	—	—	—	—	+	r	—	—	—	—	—
—	r	—	r	+	—	—	—	—	—	—	r	—	—	—	—	—
—	r	+	—	r	—	—	—	—	r	—	r	—	—	r	—	—
r	+	r	r	r	—	—	—	—	—	—	—	—	—	—	—	—
r	r	r	r	+	—	—	r	—	—	—	r	—	r	—	—	—
—	r	r	—	r	r	—	—	r	—	+	r	—	—	—	—	—
r	r	+	r	+	—	—	—	—	—	—	+	—	—	—	—	—
—	r	r	—	—	—	—	—	c	c	c	+	c	—	—	+	—
—	—	r	—	—	—	—	—	—	+	—	+	—	—	—	r	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	r	—	—	—	—	—	—	—	—	r	+	—

Table IV.

Month	4	4	4	4	5	5	5	5	6	6	6
Day	3	9	22	29	7	14	20	26	13	19	26
Eucampia zodiacus Ehr.	—	r	c	—	+	r	—	—	—	—	r
Guinardia flaccida Castr.	—	—	—	—	—	—	—	—	+	c	c
Lithodesmium undulatum Ehr.	—	—	r	—	—	—	—	—	—	—	r
Nitzschia delicatissima Cl.	—	—	—	+	+	+	+	cc	cc	—	—
Rhizosolenia delicatula Cl.[1]	—	—	—	—	—	—	—	—	—	—	—
R. robusta Norm.	—	—	—	—	—	—	—	—	—	—	—
R. setigera Btw.	—	—	—	—	—	—	—	—	—	—	—
R. Shrubsolei Cl.	—	—	—	—	+	r	—	r	+	c	c
R. Stolterfothii H. Per.	—	—	—	—	—	—	—	—	—	—	—
Streptotheca thamesis Shrubs.	—	—	—	—	—	—	—	—	—	—	r
Planktontype	Ns.	Ns.	Nm.	C.	C. Nm.	C.	C.	C.	C.	Nm.	Nm.

[1] This new species will be described in my paper on the plankton of the North Sea and Skagerak in 1898.

Helder 1897.

7	7	7	7	7	8	8	8	9	9	9	9	9	10	10	11	12
3	7	14	23	29	5	12	28	3	9	15	22	29	21	28	12	8
—	r	—	—	r	—	—	+	r	r	cc	c	+	c	+	—	—
cc	c	+	+	+	—	—	—	—	—	r	+	r	c	+	+	—
—	r	r	—	—	r	—	—	—	r	r	r	r	r	r	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	r	r	—	—	—	—	—	—	—	—	—	—	+	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	r	r	r	+	+
—	+	—	—	—	—	—	—	—	—	—	—	r	r	—	—	—
cc	cc	cc	r	+	+	—	—	—	—	—	r	—	r	—	—	—
r	r	r	cc	cc	c	r	—	—	—	—	—	—	c	cc	+	—
r	r	r	—	—	—	—	—	—	—	—	—	—	—		—	—
Nm.	Nm.	Nm.	Nm.	Nm.	Nm.	Nm.	Nm.	Nc. (Nm.)	Nc. Nm.	Nc. Nm.	Nc. Nm.	Nc. Nm.	Nc. Nm.	Nc. Nm.	Nc. (Nm.)	(Nm.)

Table V.

Month	1	2	2	2	4	4	4	5	5	6	7	7	7
Day	16	5	17	23	1	7	15	4	21	24	21	23	30
Halosphæra viridis Schmitz	—	—	—	—	—	—	—	—	—	—	—	—	r
Ceratium furca Duj.	—	—	—	—	—	—	—	—	—	—	+	—	r
C. fusus Duj.	—	r	r	—	r	—	r	r	r	+	+	—	r
C. tripos Nitzsch	—	—	r	—	—	—	—	—	—	—	+	—	+
var. longipes Bail.	r	r	c	—	—	—	—	—	—	—	r	—	—
Dinophysis acuta Ehb.	—	—	—	—	—	—	—	—	—	r	r	—	r
Diplopsalis lenticula Bergh	—	—	—	+	—	—	—	—	—	+	—	—	+
Peridinium divergens Ehb.	—	—	—	—	—	—	—	—	—	r	r	—	r
var. depressa Bail.	—	—	—	—	—	—	—	—	—	—	—	—	—
P. Michaëlis Ehb.	—	r	—	—	—	—	—	—	—	r	r	—	—
Phæocystis Pouchetii Lagh.	—	—	—	—	—	—	—	r	—	—	—	—	—
Asterionella spathulifera Cl.	—	r	—	—	—	—	—	c	—	—	—	—	—
Biddulphia mobilensis Bail.	cc	c	c	cc	c	c	c	r	—	—	—	—	—
Cerataulina Bergonii H. Per.	—	—	—	—	—	—	—	r	r	r	—	—	r
Chætoceros (borealis var.) densus Cl.	—	—	—	—	+	r	+	r	—	—	—	—	—
C. curvisetus Cl.	—	—	—	—	r	—	—	—	—	—	—	—	—
C. danicus Cl.	—	—	—	r	—	—	—	—	—	—	—	—	—
C. debilis Cl.	—	—	—	—	r	r	r	r	—	—	—	—	—
C. decipiens Cl.	r	r	r	r	r	—	—	r	—	—	—	—	—
C. (didymus var.) longicruris Cl.	—	—	—	—	—	—	—	—	—	—	—	—	—
C. Lorenzianus Gran.	—	—	—	—	—	—	—	—	—	—	—	—	—
C. Schüttii Cl.	—	—	—	—	—	—	—	—	—	—	—	—	—
Corethron hystrix Hensen	—	r	—	r	—	—	—	—	—	—	—	—	—
Coscinodiscus concinnus W. Sm.	c	+	+	c	r	—	+	—	—	—	—	—	—
C. excentricus Ehb.	+	c	+	cc	+	+	+	—	—	—	—	—	—
Ditylum Brightwellii West.	+	+	r	+	r	r	—	r	—	—	—	—	—
Eucampia zodiacus Ehb.	—	—	—	—	—	—	—	r	—	—	—	—	—
Guinardia flaccida Castr.	—	—	—	—	—	—	+	+	c	r	—	—	—
Leptocylindrus danicus Cl.	—	—	—	—	—	—	—	—	—	—	—	—	—
Rhizosolenia alata Btw.	—	—	—	—	—	—	—	—	—	—	—	—	—
var. gracillima Cl.	—	—	—	—	—	—	—	—	—	+	—	—	r
R. robusta Btw.	—	—	—	—	—	—	—	rr	—	—	—	—	—
R. semispina Hensen	—	—	—	—	r	r	+	r	—	+	+	r	r
R. Shrubsolei Cl.	—	r	—	—	—	—	+	c	+	+	c	r	+
R. Stolterfothii H. Per.	—	—	—	—	—	—	—	r	c	c	+	+	+
R. styliformis Btw.	—	r	—	—	—	—	—	rr	—	r	—	—	—
Skeletonema costatum Grev.	—	—	—	r	—	r	r	+	—	—	—	—	—
Streptotheca thamesis Shrubs.	+	+	—	r	r	r	+	c	—	—	—	—	—
Planktontype	Nc.	Nc.	Nc. Ns.	Nc.	Nc.	Nc.	Nc.	Nm.Ns.	Nm.	Nm. (Ns.)	Nm. (Ns.)	Nm.	Nm.

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8	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	11	12	12	12
5	10	17	23	2	7	17	30	6	12	23	28	3	18	20	23	29	2	11	20
—	—	r	—	—	—	+	r	r	—	—	—	r	+	+	—	—	—	—	—
+	+	r	—	—	·	—	·	—	—	—	—	—	—	r	—	—	—	—	—
+	+	r	—	—	—	—	—	—	—	r	r	—	—	—	—	—	—	—	—
+	—	r	r	+	c	+	c	—	+	+	+	—	—	cc	+	+	+	—	—
—	—	r	+	—	c	r	—	—	r	—	·	—	—	—	—	—	—	·	—
+	r	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
cc	c	—	—	—	—	—	r	—	—	—	—	r	—	r	+	—	+	—	—
+	r	r	c	r	+	+	—	+	—	—	—	—	—	—		—	—	—	—
—	—	r	+	—	+	+	—	—	—	—	—		—	—	—	—	—	—	—
r	—	—	—	—	—	—	·	—	—		·	—	—	—	—	—	—	·	—
—	—	—	—	—	·	+	+	—	—	—	—	—	—	—	—	—	—	—	—
—	r	—	c	—	·	—	—	—	—	r	—	—	cc	r	r	—	—	—	—
—	—	—	r	r	r	r	—	r	r	cc	+	c	+	+	c	—	+	r	+
—	—	—	—	—	—	—	—	—	r	r	r	—	—	—	·	—	—	—	—
—	r	r	+	—	—	+	—	cc	—	r	r	—	—	—	—	—	—	—	—
—	r	—	+	+	r	r	—	r	—	—	—	—	—	—		—	—	—	—
—	—	—	—	—	—	—	—	·		·	·	—	r	+	r	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	—	—	—	—
—	—	—	—	r	—	—	—	—	r	—	—	—	r	cc	c	—	c	r	r
—	—	—	+	r	—	r	—	—	—	—	—	—	—	—	—	—	—	—	—
—	r	—	—	—	r	—	—	—	—	—	r	—	—	—	—	—	—	—	—
r	r	—	+	r	—	—	—	·		—	—	—	r	r	—	—	—	—	—
—	—	—	—		—	—	—	—	—	—	—	—	—	r	—	—	—	—	—
—	—	r	—	—	—	r	—	—	—	r	—	—	r	+	c	+	+	r	r
—	—	—	—	—	—	r	—	—	r	r	—	r	—	+	+	+	+	r	r
—	—	—	·	—	—	—	—	—	—	—	—	—	r	r	—	—	—	—	—
—	—	—	r	—	—	—	—	r	r	r	r	—	—	r	—	—	—	—	—
—	r	—	r	r	r	r	r	—	r	r	r	—	r	—	—	—	—	—	—
—	+	—	+	r	—	—	—			—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	r	+	r	+	+	—	r	r	r	+	—	—	—	—	—
r	+	r	+	+	+	r	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	r	r	r	—	c	+	c	+	—	—	r	—	—	—	—	—
—	—	r	+	c	—	—	·	—	r	—	—	—	—	—	—	—	·	—	—
—	r	—	r	+	+	—	—	+	+	r	r	—		—	—	—	—	—	—
+	+	—	—	—	r	r	r	r	—	r	r	—		—	—	—	—		—
—	—	—	—	—	—	—	r	+	—		—		·	r	—	—	—	—	—
—	—	—	—	—	—	—	—	r	—	—	—	—	·	r	·	—	—	—	·
—	—	—	—	—	—	r	—	—	—	+	r	+	r	r	r	—	—	—	—
Nm.	Nm.	Nm.	Nm.Ns.	Nm.Ns.	Nm. Ns.Tp.	Nm. Ns.	Nm. Tp.	Nm. S.	Nm. S.	Nc. S.	Nc. S.	Nc. S.	Nc. Ns.	Nc. C. Tp.	Nc. C.	Nc.	Nc. C.	(Nc. C.)	Nc. C.

Table VI.

Month	1	1	1	2	2	3	3	3	4	4	4	5
Day	4	13	26	8	23	2	16	22	1	8	22	5
Temp.	1,8	1,40	0,7	—0,45	1,5	1,8	0,25	1,45	2,35	3,45	4,50	7,65
Sal.	25,64	31,13	30,62	30,62	30,74	27,97	21,94	23,30	25,71	28,46	27,22	22,16
Fritillaria borealis Lohm.	rr	—	—	r	r	—	r	r	—	—	—	r
Oikopleura dioica Fol.	—	—	—	—	—	—	—	—	—	—	—	—
Acartia Clausii Giesbr.	—	—	—	—	—	—	—	—	—	rr	—	r
A. longiremis Lilljeb.	r	r	r	—	—	—	—	r	—	rr	+	—
Centropages typicus Kröyer	—	—	—	—	—	—	—	—	—	—	—	—
C. hamatus Lilljeb.	—	r	r	—	—	—	—	+	—	rr	—	r
Corycæus anglicus Lubb.	r	—	—	—	—	—	—	—	—	—	—	—
Euterpe acutifrons Dana	—	—	—	—	—	—	—	—	—	—	-	—
Oithona similis Claus	r	r	r	r	r	rr	—	—	—	—	r	r
Paracalanus parvus Claus	r	—	—	—	—	—	rr	rr	—	—	—	—
Pseudocalanus elongatus Boeck	—	—	r	—	—	—	rr	+	—	rr	+	r
Temora longicornis O. F. Müll.	r	—	—	—	r	—	r	+	—	—	—	—
Evadne Nordmannii Lovén	rr	—	—	—	rr	—	—	—	—	—	—	r
E. spinifera P. E. Müll.	—	—	—	—	—	—	—	—	—	—	—	
Podon Leuckartii G. O. Sars	—	—	—	—	—	—	—	—	—	—	—	r
Sagitta bipunctata Quoi & Gaim.	r	—	rr	—	r	—	—	—	—	—	—	
Cyttarocylis denticulata Ehb. (incl. var.)	rr	rr	—	r	—	—	r	—	r	rr	rr	—
Tintinnopsis campanula Ehb.	—	—	—	—	—	—	—	—	—	—	—	—
Tintinnus subulatus Ehb.	—	—	—	—	—	—	—	—	—	—	—	—
Noctiluca miliaris Suriray	r	—	—	—	—	—	—	—	—	—	—	—
Acanthometron quadrifolium Hkl.	—	—	—	rr	—	—	—	—	—	—	—	—
Plectophora arachnoides Clap. & Lachm.	—	—	—	—	—	—	—	—	—	—	—	—
Dictyocha fibula Ehb.	—	—	—	—	—	—	—	—	—	—	—	—
Distephanus speculum Ehb.	—	—	—	—	—	—	—	—	—	r	—	r
Ceratium furca Duj.	r	—	rr	rr	—	—	—	—	rr	—	—	
C. fusus Duj.	r	r	—	rr	—	—	—	—	—	—	—	rr
C. lineatum Ehb.	—	—	—	—	—	—	—	—	—	—	—	—
C. tripos Nitzsch	c	cc	+	r	+	rr	r	rr	rr	—	rr	rr
var. longipes Bail.	+	+	r	r	+	r	r	rr	rr	rr	rr	rr
var. macroceros Ehb.	—	—	rr	rr	—	—	—	—	—	—	—	—
Dinophysis acuta Ehb.	—	r	—	—	—	rr	—	—	—	—	rr	rr
Diplopsalis lenticula Bergh	r	—	—	—	—	—	—	—	—	—	—	
Gonyaulax spinifera Stein	r	—	—	—	—	—	—	—	—	—	—	—
Peridinium depressum Bail.	r	r	rr	r	r	r	r	r	rr	rr	rr	rr
P. divergens Ehb.	—	—	—	rr	—	—	—	—	—	—	—	—
P. Michaëlis Ehb	—	r	—	—	—	—	—	—	—	—	—	rr
P. pellucidum Bergh	r	r	—	rr	—	—	r	rr	rr	rr	—	rr
Halosphæra viridis Schmitz	—	—	—	—	—	—	—	—	—	—	—	—
Biddulphia aurita Lyngb.	r	r	r	r	+	+	r	r	r	—	—	—

Måseskär 1897.

5	5	5	6	6	7	7	9	9	9	10	10	10	11	11	11	11	12	12	12
14	22	29	19	29	10	19	11	20	28	9	19	26	2	10	18	25	4	17	23
9,05	12,15	13,65	14,60	16,20	14,45	18,35	15,0	14,75	13,45	11,70	11,25	9,9	8,6	7,5	8,1	7,5	5,75	4,6	—
20,67	19,59	18,75	19,73	22,02	28,07	20,80	30,14	20,83	23,87	24,01	26,34	21,52	20,29	21,32	23,30	31,89	32,17	25,08	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	–	—	—	—
—	—	—	—	—	—	—	—	+	r	+	—	r	+	r	—	+	—	—	—
—	+	—	—	—	—	—	—	—	r	—	r	—	r	—	—	+	—	—	r
r	r	r	—	—	rr	—	—	—	—	—	—	rr	—	+	—	—	+	—	+
—	—	—	—	—	—	—	—	r	r	r	r	r	r	r	r	r	—	—	—
—	r	—	—	r	—	—	—	—	—	—	—	—	r	—	r	—	—	—	—
—	—	—	—	—	—	—	—	r	rr	+	—	—	—	—	—	r	—	—	—
—	—	—	—	—	—	—	—	—	—	—	rr	—	rr	—	rr	r	r	—	—
—	+	c	c	—	cc	—	c	+	+	r	r	+	r	+	+	+	+	+	—
rr	—	—	—	c	c	c	c	c	+	+	+	+	—	r	r	+	—	—	—
r	r	r	—	r	—	—	—	—	—	—	—	r	r	r	r	+	—	+	r
r	+	+	—	r	—	—	—	—	—	—	rr	—	—	—	rr	r	+	+	—
c	+	+	+	+	+	c	—	—	—	—	—	—	—	—	rr	—	—	—	—
—	—	—	—	—	—	r	r	—	—	+	—	rr	rr	—	—	—	—	r	rr
r	—	r	rr	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	r	—	—	—	—	+	—	—	—	—	rr	—	—	—	c	c	—	—
+	+	r	rr	—	—	—	—	—	—	—	rr	rr	rr	rr	—	r	—	r	—
—	—	—	+	r	r	r	+	r	+	—	r	rr	—	rr	—	—	—	—	—
—	—	—	—	r	—	r	—	—	—	—	—	rr	rr	rr	—	—	—	—	—
—	—	—	—	—	—	—	c	c	—	—	—	—	—	—	—	—	+	—	—
—	—	—	—	—	—	—	r	—	—	r	—	—	—	—	—	r	—	—	—
—	—	—	—	—	—	—	—	—	—	—	rr	—	—	—	rr	r	r	—	—
—	—	—	—	—	—	—	—	—	—	—	r	r	—	r	—	—	—	—	—
—	—	—	—	—	—	—	—	—	r	—	—	r	r	r	r	—	—	—	—
—	r	r	—	—	—	—	—	rr	—	—	rr	rr	+	rr	+	r	r	r	r
rr	r	—	r	+	rr	—	—	rr	—	—	—	—	r	—	r	c	c	+	r
—	—	—	—	—	—	—	—	—	—	—	r	r	r	r	—	r	r	r	r
rr	c	c	+	c	c	r	r	c	+	rr	r	r	c	+	c	cc	cc	cc	cc
+	—	—	—	—	—	—	r	rr	—	r	rr	r	+	+	r	r	—	r	—
rr	—	—	r	—	rr	r	c	r	r	rr	r	—	r	—	+	+	+	—	—
—	r	—	—	—	—	—	—	—	—	—	rr	rr	r	r	—	r	r	r	—
—	—	—	—	—	—	—	—	—	—	rr	—	rr	r	—	—	—	—	—	r
rr	—	—	—	—	—	—	—	—	—	rr	—	—	—	—	r	r	—	—	—
r	r	r	rr	—	rr	—	—	—	—	—	rr	rr	—	—	—	—	—	—	—
—	—	—	—	—	—	—	r	rr	—	rr	—	rr	r	—	—	r	r	r	—
—	rr	—	—	—	—	—	—	—	—	—	—	—	—	r	—	—	—	—	—
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—	—	—	—	—	—	—	—	—	—	—	r	—	r	r	+	+	c	+	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	r	—	—	—	—

Table VI.

Month	1	1	1	2	2	3	3	3	4	4	4	5
Day	4	13	26	8	23	2	16	22	1	8	22	5
B. mobiliensis Bail.	—	—	—	—	—	—	—	—	—	—	—	—
Cerataulina Bergonii H. P.	—	—	—	—	—	—	—	r	r	r	r	r
Chætoceros borealis Btw.	—	—	r	—	r	+	+	c	c	c	c	.
var. Brightwellii	+	+	+	+	—	+	c	c	c	c	c	c
C. constrictus Gran	—	r	—	r	—	—	+	+	c	c	c	cc
C. contortus Schütt	r	—	—	—	—	r	—	r	—	—	+	.
C. criophilus Castr.	—	—	—	—	—	—	—	r	r	r	r	—
C. curvisetus Cl.	—	—	—	—	—	—	—	—	—	—	—	.
C. danicus Cl.	—	—	—	—	—	—	—	r	—	—	—	—
C. debilis Cl.	—	—	+	+	—	cc	cc	c	c	c	r	r
C. decipiens Cl.	—	—	r	r	—	c	r	+	+	c	c	.
C. diadema Ehb.	—	—	—	—	—	—	—	c	c	+	+	r
C. didymus Ehb.	—	—	—	—	—	—	—	—	—	—	—	—
C. hiemalis Cl.	—	r	—	—	r	r	—	+	r	+	+	r
C. laciniosus Schütt	—	r	—	r	r	r	r	r	—	—	—	
C. Schüttii Cl.	—	—	—	—	—	—	—	—	—	—	—	—
C. scolopendra Cl.	—	r	r	—	r	r	r	r	+	+	+	r
C. socialis Laud.	—	—	—	—	—	+	—	r	c	+	—	—
C. teres Cl.	—	—	r	r	r	+	+	+	+	+	—	—
Coscinodiscus concinnus W. Sm.	+	—	r	—	—	+	c	+	+	—	r	—
C. oculus iridis Ehb.	+	—	+	c	c	c	cc	c	c	r	rr	—
Ditylum Brightwellii West	—	—	—	—	—	—	—	—	—	—	—	—
Eucampia zodiacus Ehb.	—	—	—	—	—	—	—	—	—	—	—	—
Guinardia flaccida Castr.	—	r	r	—	—	—	—	—	—	—	—	—
Leptocylindrus danicus Cl.	—	—	—	—	—	—	—	r	r	+	c	c
Nitzschia seriata Cl.	—	—	—	—	—	—	+	+	+	+	r	—
Rhizosolenia calcar avis Schulze	—	—	—	—	—	—	—	—	—	—	—	—
R. gracillima Cl.	—	—	—	—	—	—	—	—	—	—	—	+
R. obtusa Hensen	—	—	—	r	r	—	r	r	r	+	+	r
R. semispina Hensen	—	—	—	—	r	—	—	r	—	r	r	—
R. setigera Btw.	—	—	—	—	—	r	—	r	r	r	r	—
R. Shrubsolei Cl.	—	—	—	—	—	—	—	—	—	—	—	—
R. styliformis Btw.	—	—	—	—	—	—	—	—	—	—	—	—
Skeletonema costatum Grev.	c	r	—	—	—	—	—	—	—	r	—	—
Thalassiosira gravida Cl.	—	—	—	r	r	—	r	—	r	r	—	—
T. Nordenskiöldi Cl.	r	r	—	r	cc	cc	cc	c	c	r	r	—
Thalasisothrix Frauenfeldii Grun.	+	cc	c	r	+	r	—	+	r	+	+	+
T. longissima Cl. & Grun.	c	c	cc	c	c	+	—	+	—	r	r	—
Planktontype	Tp. T.	Tp T.	Tp. T.	T.	Si. T.	Si. C.	Si. C. / Nc.	C. Si.	C. Si.	C. Ns.	C. Ns.	C. Ns

Måseskär 1897.

5	5	5	6	6	7	7	9	9	9	10	10	10	11	11	11	11	12	12	12
14	22	29	19	29	10	19	11	20	28	9	19	26	2	10	18	25	4	17	23
—	—	—	—	–	—	—	—	—	r	—	r	–	r	r	r	r	r	—	—
—	r	r	r	r	—	+	—	r	—	—	r	—	r	—	r	r	r		—
—	—	—	—	—	—	—	—	—	—	—	r	—	–	—	r	r	r	—	—
c	—	r	r	—	—	—	—	—	—	—	r	—	-	r	-	r	r		r
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r	—	—	—	—	—	—		—	—	—	—	-	—	—	—	—	—	—	—
—	—	—	r	r	—	—	—	c	c	c	c	cc	c	cc	c	+	+	—	r
—	—	—	—	—	—	—	—	—	—	—	r	–	—	—	r	r	—	—	—
r	-	—	—	—	—	—	—	—	—	—	c	r	r	r	—	—	–	—	—
+	r	r	—	—	—	—	—	—	—	—	—	—	-	r	r	r	—	—	—
—	—	—	—	—	—	—	—	—	—	r	r	r	-	r	r	—	—	—	—
—	—	r	—	—	—	—	—	c	c	c	c	c	c	c	+	—	r	—	—
r	r	r	—	—	—	-	—	—	—	—	—	—	-	r	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	r	—	r	r	r	—	—	—
—	—	—	—	—	—	—	+	c	cc	cc	+	+	c	r	—	—	—	—	—
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—	—	—	r	—	—	—	rr	—	—	r	r	r	r	—	r	r	r	r	—
—	—	—	—	—	—	—	—	—	—	—	r	—	—	—	r	r	r	—	—
—	—	—	—	—	—	r	rr	—	—	—	—	r	r	r	r	r	—	r	—
c	c	+	—	—	—	—	—	—	—	r	—	—	—	r	—	—	—	—	—
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—	—	—	—	—	—	—	rr	—	—	—	r	—	—	—	+	+	+	—	—
cc	cc	cc	cc	cc	ccc	ccc	—	c	c	cc	+	c	c	c	c	c	—	—	—
—	—	—	—	—	—	—	—	—	-	—	—	-	—	—	—	—	—	—	—
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r	—	—	—	—	—	—	—	—	—	—	r	—	r	—	r	—	+	—	—
—	—	—	—	—	r	—	—	—	—	—	r	—	r		r	—	r	—	—
—	—	—	—	—	—	—	r	—	—	—	—	-	—	—	r	+	+	—	—
—	—	-	—	—	—	-	-	—	—	r	r	c	c	c	r	r	—	rr	—
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—	—	—	—	—	—	—	—	—	—	—	—	-	—	—	—	—	—	—	—
+	c	c	—	—	—	—	—	—	—	—	—	—	r	—	r	—		—	—
r	—	—	—	—	-	—	—	—	—	—	r	r	r	r	+	r	c	r	+
Ns. Nm.	Nm. Tp. Ns.	Nm. Tp.	Nm.	Tp. Nm.	Nm. Tp.	Tp. Nm.	S. Tp.	Nm.	Nm.	Nm.	{ Nm. (Ns.)	Nm. (Ns.)	Nm. Tp. (Ns.)	Nm. Tp. (Ns.)	Nm. Tp. Ns.	Tp. Nc. S.	Tp. T. Nc.	Tp. Nc.	Tp. T. Nc.

KONGL. SVENSKA VETENSKAPS-AKADEMIENS HANDLINGAR. Bandet 32. N:o 8

THE PLANKTON

OF

THE NORTH SEA, THE ENGLISH CHANNEL, AND THE SKAGERAK

IN

1898

BY

P. T. CLEVE

COMMUNICATED TO THE R. SWEDISH ACADEMY OF SCIENCES OCTOBER 11, 1899

STOCKHOLM
KUNGL. BOKTRYCKERIET. P. A. NORSTEDT & SÖNER
1900

For the hydrographical researches of Pettersson and Ekman,[1] the North Sea was explored four times during the year 1898, viz.: in March, June, July—August and November. At the same time samples of water were taken for chemical analysis and of plankton for microscopical examination. At the biological stations at Plymouth and Helder samples were collected almost every week during the whole year and also at S:t Vaast la Hogue from June onwards. For this valuable assistance I beg to tender the directors of the said stations, Mr. E. J. Allen, Dr. P. P. C. Hoek and Mr. Eugène Malard my best thanks. Again, at the expense of the Fishery Association of Gothenburg, samples of plankton were collected almost every week at Måseskär, off the west coast of Sweden, and, though with less regularity, both in the open Skagerak and along the Swedish west coast from Vinga to Väderö.

1. The North Sea in March 1898.

The prevailing plankton type is the *chæto-plankton*, which extends from the British east coast, between the Firth of Tay and Newcastle, to the south-west of Norway and the west of the Danish Peninsula, to about 55° 30′ N., i. e. above the 100 metre plateau. It also occurred south of the Dogger Bank, above the depression of the bottom at this place.

The chæto-plankton region approximately coincides with the southern part of the region of the water with 35 p. mille salinity, as marked on the hydrographical map of Pettersson and Ekman.[1] The northern part of the North Sea, or above the 200 metre plateau, was poor in plankton or almost sterile, containing *Calanus finmarchicus* sparingly. Above the great depth between the 200 metre plateau and the west coast of Norway the water was extremely poor in plankton, containing however some rare specimens of a number of interesting radiolarians, *Ceratium arcticum* and *Coscinodiscus oculus iridis*.

In the spring of 1897, when chæto-plankton also prevailed above the 100 metre plateau, the area of this plankton type was bordered by a band containing arctic and northern forms. This was not the case in 1898. The southern part of the chæto-region, from Newcastle to Skagen, in 1898 contained *Coscinodiscus concinnus* more or less abundantly; and above the edge of the 50 metre plateau as well as above the Fisher Bank *Rhizosolenia styliformis* was met with, more or less sparingly to about 1° 30′ E. and also above the depression south of the Dogger Bank.

[1] Bih. till K. Sv. Vet.-Akad. Handl. Vol. XXV, II, N:o 1. 1899.

As no samples of plankton have been collected above the 50 metre plateau nothing is known about the plankton of the southern North Sea.

The *tripos-plankton*, prevalent during the past summer, autumn, and winter above the 100 metre plateau, occurred in March 1898 chiefly in the eastern part of the North Sea and west of the Danish Peninsula, and there more or less intermingled with chæto and northern neritic plankton: the last-named was present during the winter in the Skagerak.

Origin of the chæto-plankton. I propose in another paper to treat of the origin of the chæto-plankton, and it will there be shown that the diatom, *Chætoceros decipiens*, which constitutes the principal mass of the chæto-plankton, belongs to the west Atlantic area, or to the cold southwards current along the American coast, and that it is thence conveyed by under-currents across the Atlantic towards the Azores and the European coast. In the month of November, when the superficial strata of the Atlantic are driven away — or rather become mixed with those beneath — the species above-mentioned appears at many points between the Newfoundland Banks, the Azores and the mouth of the English Channel. It multiplies during the winter and is conveyed in the spring towards Iceland, the Färöe Channel and into the North Sea, whence it spreads towards Spitzbergen. Other species of the west Atlantic area, which accompany *Chætoceros decipiens* across the Atlantic, such as *Calanus finmarchicus*, *Thalassiothrix longissima* and *Ceratium arcticum*, die sooner or later in water of so high a salinity as 35 p. m.

Some species of the temperate Atlantic, such as *Oncæa minuta*, *O. conifera*, *Oithona plumifera*, *O. similis*, *Collozoum inerme*, frequently follow the chæto-plankton on its way towards the north.

Species which accompany the Chætoceros decipiens into the North Sea. The following species occurred in the North Sea over the whole chæto area or at least in its western parts. Some of them are of southern origin, or belong essentially to the *styli* and *desmo types*, others come from northern regions and from Scotland.

Species of southern origin	Species of northern origin
Acartia Clausii,	*Calanus finmarchicus*,
Microsetella atlantica,	*Metridia hibernica*,
Oithona similis,	*Pseudocalanus elongatus*,
Sagitta bipunctata,	*Temora longicornis*,
Globigerina bulloides,	*Cyttarocylis denticulata*,
Acanthometron quadrifolium,	*Gonyaulax spinifera*,
Halosphæra viridis.	*Chætoceros borealis var. Brightwellii*,
	Coscinodiscus oculus iridis,
	C. polychordus,
	Rhizosolenia semispina.

Biddulphia mobilensis and *Streptotheca Thamesis* come in all probability from the coasts of Scotland.

Among the species mentioned above, *Halosphæra* is not equally distributed over the whole chæto area. It could be traced from the south west of Norway to Newcastle and as far to the north as beyond the 63rd degree of latitude and 0° long.; also from the south of Norway to Skagen and into Skagerak.

2. The North Sea in June 1898.

The chæto-plankton of the spring has almost completely disappeared, some few remnants lingering west of the Danish Peninsula (at 56° N.) and west of Norway (61° N. 2° 30′ E.). Its place is now occupied by *tripos-plankton*, which is the ruling type at this time of the year. It is more richly represented in the eastern than in the western parts of the area.

To the east of the British coast the tripos-plankton is mixed with northern neritic forms, such as *Ceratium tripos v. longipes*, and at the west of the Danish Peninsula and north of the German coast with *Peridinium depressum*.

The southern part of the North Sea contains, north of the continental coast, southern neritic plankton, mixed with styli-plankton.

The hydrographical map for June 1898 by Ekman and Pettersson shows in the north between Norway and Scotland a tongue of 35 p. m. water, temp. 9° to 10°. No samples of plankton from this area have been examined by me. One sample from 61° 50′ N. 2° 30′ E., which may be assumed to be from that kind of water, contained tripos-plankton, but not abundantly.

The bulk of tripos-plankton in my samples had come from the northern or eastern part of the region coloured as containing 34 p. m. water.

The hydrographical map in its south western corner shows an area of 35 p. m. water, indicating that a flow of Atlantic water enters into the North Sea from the south. This fact accounts for the considerable development of the southern neritic plankton above the 50 metre plateau.

Species which seem to come into the North Sea round the north of Scotland. As stated above there are among the plankton, some northern species east of the Scotch coast to Newcastle, such as *Ceratium longipes*. But, on the other hand, there are also in the western region of the North Sea some southern species. I name the following:

Northern forms	Southern forms
Calanus finmarchicus,	*Acartia Clausii*,
Evadne Nordmannii,	*Labidocera Wollastonii*,
Cyttarocylis gigantea.	*Evadne spinifera*,
	Ceratium macroceros,
	Lauderia annulata,
	Peridinium divergens.

In fact the tripos-plankton seems among the prevailing mass of southern origin to contain a certain amount of northern species.

Two remarkable species, *Halosphæra* and *Microsetella*, have disappeared from the North Sea since the spring.

Species in the southern neritic plankton. The flow of Atlantic water through the English Channel into the North Sea had already taken place before the month of June. This becomes apparent if we consider the plankton collected at Helder. *Phæocystis Pouchetii* was very abundant there in April and the beginning of May. It was seen in the beginning of April at Plymouth. When that species disappeared from Helder (before the 12th of May) a number of southern forms, such as *Noctiluca*, *Ceratulina Bergonii*, *Eucampia zodiacus*, *Guinardia flaccida* and *Rhizosolenia Stolterfothii* began to develop.

In June we find that the typical Atlantic species *Rhizosolenia styliformis* had spread over the whole area from Holland to Skagen, thus indicating that Atlantic water had arrived from the E. Channel before June and that its plankton had been dispersed through the water with low salinity off the continental coast. The following species of the southern neritic plankton occur normally in the open Atlantic:

Acurtia Clausii,
Paracalanus parvus,
Diplopsalis lenticula,
Rhizosolenia styliformis.

The following species live, as a rule, above the coast banks, or only occur exceptionally in the ocean:

Animals.	Plants.
Acartia longiremis,	*Chætoceros densus*,
Centropages hamatus,	*C. didymus*,
Temora longicornis,	*C. Villei*,
Podon Leuckartii,	*Eucampia zodiacus*,
Noctiluca miliaris.	*Guinardia flaccida*,
	Lauderia annulata,
	Rhizosolenia Shrubsolei,
	Rh. Stolterfothii,
	Stephanopyxis turgida.

Of these species the *Noctiluca* is the most important. It seems to be confined to the English Channel and the continental coasts of the North Sea. I have not seen a single specimen in any of the thousand plankton-samples from the Atlantic, which I have examined.

3. The North Sea in July—August 1898.

But few plankton-samples were collected at this period and those only from the eastern and southern parts of the North Sea, so that they cannot afford us a complete insight into the state of the North Sea.

The plankton-type which prevails in the east, i. e. from Skagen to 4° E. and 55° N., is the *tripos-plankton*. From the 55th degree to the English Channel southern neritic plankton is the ruling kind. The areas of the water with 33 to 34 p. m. salinity on the hydrographical map by Pettersson and Ekman contain chiefly tripos-plankton, as far at least as the 55th degree of latitude, but south of it there is *southern neritic plankton*, which is also the case with the area with 34 to 35 p. m. salinity, north of the coast of Belgium.

Some species from the preceding period, such as *Oithona similis*, *Paracalanus parvus*, *Pseudocalanus elongatus*, *Ceratium macroceros* and *Guinardia flaccida* have evidently increased in abundancy, others, such as *Evadne Nordmannii*, *E. spinifera* and especially *Rhizosolenia styliformis* have decreased. *Podon intermedius* and *Oikopleura dioica* begin to develop.

4. The North Sea, November—December 1898.

The prevailing plankton type is the *tripos-plankton*, which extends from the north-east of Scotland to the south west of Norway and to Newcastle. From there the limit can be traced to 53° N. 4° E. and from this point to Skagen. The tripos area corresponds thus on the whole with the area of 35 p. m. water on the hydrographical map by Ekman and Pettersson. As the salinity of the tripos region is higher now than it was in July—August, it is evident that a considerable amount of Atlantic water has entered the North Sea, which also becomes apparent when the composition of the plankton is considered in details.

We note first that the Atlantic organism *Halosphæra*, not seen since the spring, occurs now round Scotland, across the North Sea to Norway and Skagen, i. e. above the 100 metre plateau. The purely Atlantic species *Rhizosolenia styliformis* has about the same distribution. Another remarkable feature in the plankton is the abundance of *Coscinodiscus concinnus* and *Biddulphia mobilensis*, which occur in the E. Channel and spread thence to Skagen, i. e. above the 50 metre plateau.

Species of the tripos region in November. The tripos plankton contains the usual forms, such as *Ceratium tripos*, *C. macroceros* (which has considerably increased in frequency), *C. furca* and *C. fusus;* but there are besides a number of other forms, partly from the southern and partly from the northern Atlantic, as follows:

Southern species.	Northern species.
Centropages typicus c,	*Parathemisto oblivia*,
Microsetella atlantica,	*Calanus finmarchicus*,
Oithona plumifera rr,	*Metridia hibernica r*,
Paracalanus parvus cc,	*Pseudocalanus elongatus*,
Acanthochiasma fusiforme,	*Limacina balea*,
Acanthometron quadrifolium,	*Plectophora arachnoides*.
Gazelletta hexanema (*r* south of the Orkneys),	
Pyrophacus horologium.	

The *Evadne Nordmannii*, *E. spinifera*, *Podon intermedius* and *P. Leuckarti* abundant in the preceding periods, have now disappeared.

The southern neritic plankton. As characterizing the plankton above the 50 metre plateau we note now *Coscinodiscus concinnus* and *Biddulphia mobilensis*, but also a considerable number of other species, most of which have been found from the English Channel to Skagen. Among these species we note the following:

Animals.

Proto pedata, in the E. Channel in August, at Skagen in November.
Acartia bifilosa.
Coryceus anglicus.
Euterpe acutifrons, at Plymouth and Helder in September, from the E. Channel to Skagen in November.
Temora longicornis.
Sagitta bipunctata, very common above the whole 50 metre plateau.
Tintinnopsis campanula, from the English Channel to Skagen.

Plants.

Bellerochea malleus.
Chætoceros anastomosans.
Ditylum Brightwellii, abundant from the E. Channel to Skagen.
Guinardia flaccida.
Lithodesmium undulatum, observed from the end of September onwards.
Rhizosolenia robusta, from the English Channel to the mouth of the Schelde.
R. Stolterfothii, from the E. Channel to Skagen, where it appeared in the first few days of October.
Streptotheca Thamesis, from the E. Channel to 55° N. 5° 30′ E.

The Skagerak in 1898.

The seasonal changes in the plankton will be examined for certain periods with reference to the prevailing plankton-types.

Period I. January—February.

The prevailing plankton is tripos-plankton, but is partly mixed with remnants of southern neritic plankton, which disappear, and more or less rarely so with forms which belong to the northern neritic plankton and increase in frequency in the next period.

Besides the most commom dinoflagellates of the tripos type, we note some more remarkable species such as *Halosphæra*, which was more or less common in the whole of the Skagerak, and *Arachnactis albida*, not formerly found in the Skagerak. The last-named species was seen during the last few days of January and the first few days of February both in the open Skagerak and along the coast from Vinga to Måseskär. This pelagic actinia is known from

Florö in Norway (winter-time), from 56° 35′ N. 20° 19′ W. (25th of September, C. Vogt), and from 60° N. 7° W. (the 29th of March 1893, Vanhöffen). In the year 1898 it was found by Ostenfeld in a sample from 60° 12′ N. 3° 53′ W. (21th of August) and from 59° 59′ N 5° 56′ W. (14th of September). I found it in a collection from 60° 10′ N. 3° 12′ W. (the 6th of September 1898) and from 62° 12′ N. 0° 37′ E. (the 8th of September 1899). The abundancy and sudden appearance of this species over a wide area of the Skagerak in 1898 proves better than anything else that the plankton of the Skagerak is of foreign origin. It is worthy of note that another species, not formerly observed in the Skagerak, was found at the same time viz. *Dictyocysta elegans*, a species that is not rare in the temperate Atlantic nor in the Färöe Channel.

Period II. February—March and April.

This period is characterized by the abundance of arctic and northern species (*Si*, *T*, *Ns*). They had already appeared in the previous period, but did not reach such a considerable development as now. In connection with these northern forms *Chætoceros decipiens* also appears, a species which, as stated above, was the dominant one in the North Sea in March.

The organisms which characterize this period are principally *diatoms*, animals and dinoflagellates being as a rule rare. The diatoms belong to the boreal and arctic regions of the Atlantic. Most of the southern species, which were abundant in the autumn, have disappeared or are scarce, among them *Halosphæra*.

The most decided arctic species, such as *Thalassiosira Nordenskiöldii*, *Chætoceros socialis*, continue during February only and have already disappeared by the middle of March. Others, such as *Chætoceros debilis*, *C. diadema*, *Nitzschia seriata*, continue during April. The most long-lived ones, such as *Thalassiothrix Frauenfeldii*, *Leptocylindrus danicus*, *Rhizosolenia semispina*, *Chætoceros constrictus*, *C. contortus*, *C. hiemalis* do not disappear before the end of May or in June, by which time a number of southern species have become frequent.

The most common diatoms during this period are the following:

Chætoceros constrictus,	*Chætoceros socialis*,
C. contortus,	*Coscinodiscus oculus iridis*,
C. debilis,	*Thalassiosira gravida*,
C. decipiens,	*T. Nordenskiöldii*,
C. diadema,	*T. Frauenfeldii*.

Period III. May and June.

This period is remarkable for the abundance of euryhaline species, such as the following:

Animals.	Plants.
* *Acartia longiremis*,	*Cerataulina Bergonii*,
* *Centropages hamatus*,	* *Chætoceros danicus*,

* *Temora longicornis*,
* *Evadne Nordmannii*,
* *Podon Leuckartii*.

Rhizosolenia delicatula,
R. gracillima.

The sign * denotes that species marked thus occur as far into the Baltic as at least to Åland.

Whether these forms are indigenous in the Baltic or enter there from the Cattegatt by means of undercurrents, cannot as yet be decided, as they usually appear simultaneously in the Baltic and along the west coast of Sweden. *Cerataulina Bergonii* comes no doubt through the E. Channel, but *Rhizosolenia gracillima*, although common in the styli-plankton of the Atlantic, does not occur to any extent in the North Sea. The new species *Rh. delicatula* occurs in the southern part of the North Sea.

In the Skagerak, at some distance from the coast, *tripos-plankton* occurs from the middle of May onwards, associated with some more saline or Atlantic species such as *Acartia Clausii*, *Calanus finmarchicus* and *Oithona similis* or euryhaline ones such as *Pseudocalanus elongatus* and *Evadne spinifera;* these become abundant along the coast during the next period.

Period IV. July to the end of August.

The prevailing plankton type is now *tripos-plankton*, but with an admixture of species remaining from the last period, and of *southern neritic plankton*.

Among the organisms we note the following:

Animals.	Plants.
Oikopleura dioica,	*Ceratium tripos*,
Acartia Clausii,	*C. macroceros*,
Calanus finmarchicus,	*Rhizosolenia gracillima*.
Oithona similis.	
Paracalanus parvus,	
Evadne spinifera,	
Sagitta bipunctata.	

Period V. From the end of August to the end of October.

The *tripos-plankton* continues as before, but now the *didymus-plankton* appears with the three species *Chætoceros curvisetus*, *C. didymus* and *C. Schüttii*, all at the same time and abundantly. From the beginning of September *Centropages typicus* was common and together with this copepod appeared also *Anomalocera Patersonii*, *Labidocera Wollastonii*, *Acanthometron quadrifolium* and *Limacina balea*, all probably, with the exception perhaps of Labidocera, from the North of Scotland.

Period VI. From the end of October to the end of December.

The *tripos-plankton* remains throughout, but in this period *Halosphæra* appears. A number of *northern forms* begin to develop, and the southern species, formerly so abundant, decrease in frequency and die sooner or later. The currents from the south still continue

to convey into the Skagerak such forms as *Chætoceros danicus*, *Ditylum Brightwellii*, *Guinardia flaccida* and *Proto pedata*, which latter is not rare in December.

The northern forms are principally diatoms, such as:

Chætoceros borealis,	*Chætoceros similis*,
C. constrictus,	*C. teres*,
C. contortus,	*Coscinodiscus polychordus*,
C. debilis,	*Rhizosolenia setigera*,
C. diadema,	*Skeletonema costatum*,
C. laciniosus,	*Thalassiosira gelatinosa*,
C. scolopendra,	*Thalassiothrix Frauenfeldii*.

The seasonal changes in the plankton of the Skagerak were in 1898 *on the whole* similar to those in 1895, 1896 and 1897.

January	*Tp*, *Ns*, *Nh*,
February—April	*Si*, *Ns*, (*T*), *C*,
May, June	*Nm α*,[1]
July, August	*Tp*, *Nm α*,
September, October . . .	*Tp*, *Nm*,
November, December . .	*Tp*, *Ns*, *Nm*.

Seasonal distribution of the plankton-organisms in the North Sea and the Skagerak.

Ascidiacea.

Fritillaria borealis Lohm. — *January:* rare in the Skagerak. *March:* rare at Måseskär.

Oikopleura dioica Fol. — *January:* rare in the Skagerak and at Måseskär. *March:* in the North Sea at 57° 18′ N. 8° 27′ E. and 55° 43′ N. 7° 29′ E. *June:* sparingly in the Skagerak. *July*, *August:* from the E. Channel to west of Skagen, common in the Skagerak and along the coast, remains more or less abundant to *November*.

Amphipoda.

Parathemisto oblivia Kröyer. — *September:* rare in the Skagerak. *November:* rare SW. of Norway (58° 12′ N. 5° 30′ E.).

[1] I propose to designate as *Nm α* the plankton in which *Rhizosolenia gracillima* occurs abundantly.

Proto pedata Leach. — *January* and *February* (31. I and 1. II): rare in the Skagerak. *August:* from the E. Channel to Helder. *November:* north of Holland and west of the Danish Peninsula, west coast of Sweden, where it was abundant in *December*.

Cladocera.

Evadne Nordmannii Lovén. — *May:* at Måseskär. *June:* common in the North Sea, between 56° and 58° N., from W. Norway to 0° 38′ E. and to Skagen, common in the Skagerak, where it remains until *August*. Along the coast it remains in *October*. Rare at Plymouth from July to September.

E. spinifera P. E. Müller. — Appears in *June* abundantly in the region between Firth of Tay and W. Norway (Stadt) and Skagen, in the Skagerack and along the coast. In *July*, *August* it was found from Skagen to the west of the Danish peninsula. In the Skagerak it remains until *October* and along the coast until the middle of *November*. At Plymouth rare in August.

Podon Leuckarti G. O. Sars. — *June:* rare west of the Danish Peninsula and in the Skagerak. *July:* rare at the entrance to the Skagerak.

P. intermedius Lilljeb. — *July*, *August:* more or less abundant west of the Danish Peninsula, from the mouth of Elbe to Skagen, rare at Plymouth, more or less rare in the Skagerak, where it remains until *October*, or along the coast to the end of that month.

P. polyphemoides Leach. — Rare in August and September at Helder.

Copepoda.

Acartia bifilosa Giesbr. — *November:* from the E. Channel to Holland and the west of Skagen.

A. Clausii Giesbr. — The whole year in the North Sea, in the Skagerak and at Plymouth. *January to April or May:* rare at Plymouth and in the Skagerak. *March:* in the North Sea, together with *Halosphæra*, common between the Shetlands and Norway. West and south of Norway. South of the Dogger bank. East of Newcastle. *June:* British east coast from Firth of Tay to Newcastle, common. From Holland to Heligoland. Plymouth (maximum from the middle of May to the beginning of September). St. Vaast la Hogue not rare. In the Skagerak not rare from the end of May or beginning of June to October, November (maximum from the middle of August to the end of that month). *July*, *August:* from the Channel to Skagen and above the Fisher Bank. *November:* the E. Channel, Helder, Skagen to the south of Norway. South of the Orkneys.

A. longiremis Lilljeb. — In the North Sea in *March* SW. of Norway and E. of Newcastle, in *June* abundantly in the middle of the North Sea, 57° N. 3° E. and at

54° N. 5° E. *July:* Dutch coast and along the Danish coast to Skagen, not common. *November:* not seen. In Skagerak common in the beginning of June, more or less common in July, along the coast the whole year (maximum June, July).

Anomalocera Patersonii Templ. — *March:* Sparingly west of the Clyde. — Skagerak: more or less rare in *July* and in the beginning of *October*. Along the coast: rare the 30. I at Måseskär; from *July* to the beginning of *November*, rare to common.

Calanus finmarchicus Gunn. — A. North Sea: *March* scattered on the space between Stavanger and the Fisher Bank, Firth of Tay and Newcastle, also above the depression S. of the Dogger Bank. *June:* sparingly between Norway and the Shetlands, W. of Firth of Tay and Newcastle, N. of the Dutch coast, S. of Norway. *July, August:* sparingly N. of Holland and at Skagen. *November:* more or less abundant from the Hebrides and the Orkneys to the south of Norway, in the company of *Halosphæra*. Very rare off the continental coast.

B. Plymouth: rare from the end of *May* to the middle of *July* and from the end of *September* to the middle of *November*.

C. Skagerak: common in the middle of *June*, more or less rare until the middle of *November*. Along the coast: rare in *January* and *February*, more or less common from *August* to *December*.

Candace pectinata Brady. — North Sea: rare in *March* east of Firth of Tay; very rare at Skagen in *November*.

Centropages hamatus Lilljeb. — North Sea: *March* sparingly SW. of Norway and W. of Hanstholm. *June:* not rare on the Dutch coast, together with *Noctiluca*, not rare on the north of the Dogger and Fisher Banks. *July:* not rare N. of the Dutch coast and above the Fisher Bank. *November:* the Channel. — Helder: rare in April and from *August* to *October*. — St. Vaast la Hogue: rare in June. — Skagerak: from *March* to *November;* along the coast from *March* to *November, December*, maximum in June and November.

C. typicus Kröyer. — A. North Sea: *March:* rare at 57° 21′ N. 2° 27′ E. *June:* rare at 61° 50′ N. 2° 30′ E. *July:* rare at 57° 21′ N. 4° 9′ E. and 57° 40′ N. 10° E. *November:* abundant from the NE. end of Scotland to southern Norway, following *Calanus finmarchicus*, very rare in the E. Channel, rare at Helder in December.

B. Plymouth: the whole year, maximum from May to November.

C. Skagerak: rare in *January* (30. I), more or less abundant from *October* to the middle of *November*. Along the coast: rare in *January* and *June*, more or less abundant from the middle of *July* to *December*, maximum in September and October.

Corycæus anglicus Lubbock. — A. North Sea: *March:* rare in the E. Channel and at Hanstholm. *June:* not seen. *July:* very rare W. of the Danish Peninsula. *November:* from the E. Channel along the south coast of the North Sea to Skagen.

B. Plymouth: almost the whole year, maximum from the end of September to the middle of December.

C. Skagerak: rare in January, February, from June to December.

Euterpe acutifrons Giesbr. — The E. Channel: rare at Plymouth in January to March; common in September—December at Plymouth, St Vaast and Helder.

Labidocera Wollastonii Lubb. — Rare in the North Sea, *June*, at 56° N. 2° E. Skagerak: rare in *June;* along the coast not rare in *September, October.*

Metridia hibernica Brady & Robts. — North Sea: *March:* rare from Firth of Tay to 57° 21′ N. 2° 27′ E. *June:* rare at 56° 26′ N. 4° 13′ E. *November:* not rare SW. of Hanstholm. Skagerak: rare in January and in July. Along the coast rare in January, June, not rare in *November, December.*

Microsetella atlantica Brady & Robts. — North Sea: *March:* abundant east of Firth of Tay, more or less sparingly scattered through the chæto-region to Skagen. Also above the depression S. of the Dogger Bank. *August:* rare SW. of Norway and W. of Jutland. *November:* rare W. of the Danish Peninsula to Skagen. E. of Newcastle. — Plymouth rare in February. Skagerak: rare in July and in October.

Oithona plumifera Baird. — *March:* rare N. of the Shetlands. At 61° 32′ N. 2° 31′ E. *November:* at 56° 11′ N. 2° 31′ E. Skagerak: very rare in January.

O. similis Claus. — A. North Sea: *March:* abundant between the Shetlands and Norway, E. of Firth of Tay, more or less sparingly scattered in the whole chæto-region. Not rare W. of Denmark at 55° N. *June:* common between the Shetlands and Norway, more or less common from the Firth of Tay to Skagen. Common at 54° 25′ N. 5° 37′ E. *July, August:* more or less abundant above the Fisher Bank and from the E. Channel to Skagen. *November:* the same distribution, but rarer. — B. The E. Channel: Plymouth the whole year. St Vaast in November. — Helder from August to November. — C. Skagerak: the whole year, rare June, very common from July to December.

Paracalanus parvus Claus. — A. North Sea: *March:* not seen. *June:* rare from the E. Channel to the north of Holland. *July, August:* abundant from the E. Channel along the south coast to the Fisher Bank and Skagen. *November:* as before, but also from the north of Scotland to the south of Norway. — B. Plymouth: the whole year, maximum from August to December. C. Skagerak: very rare in January, February, abundant from July to October, November.

Pseudocalanus elongatus Boeck. — A. North Sea: *March:* more or less abundant through the *chæto-region*, from Firth of Tay and Newcastle to Skagen, also above the depression S. of the Dogger Bank. *June:* decidedly rarer, chiefly on the 50 metre plateau, common near the E. Channel. *July, August:* above the Fisher Bank, common above the depression S. of the Dogger Bank. *November:* continues above the 50 metre plateau. From

Scotland to the south of Norway and Skagen, in the company of *Halosphæra*. — B. The E. Channel: at Plymouth from January to August, as a rule rare, at St Vaast in June. — C. Skagerak: the whole year, maximum from June to October.

Temora longicornis O. F. Müll. — A. North Sea. *March:* more or less abundant through the *chæto-region*, from Scotland to the Skagerak, above the Fisher Bank and the depression S. of the Dogger Bank. *June, July, August:* from 0° 38′ E. along 56°—57° to Skagerak. South part of the North Sea to the E. Channel. *November:* abundant from the S. of Norway to the Fisher Bank. Southern North Sea. — B. The E. Channel: at Plymouth from February to November, maximum from April to the middle of May. St. Vaast in June and rare in November, December. — C. Skagerak: the whole year, maximum from June to October.

Temorella affinis Poppe. — At Måseskär rare at the end of May, common in November.

Chætognata.

Sagitta bipunctata Quoi & Gaim. — A. North Sea. *March:* through the *chæto-region*, between Firth of Tay, Newcastle and the Fisher Bank. *June:* rare above the Fisher Bank. *July:* rare above the Fisher Bank and in the E. Channel. *November:* very abundant above the Fisher Bank, on the edge of which it seems to have its optimum; thence to the south of Norway. Above the whole 50 metre plateau. B. The E. Channel: more or less common at Plymouth from September to November. — C. The Skagerak: the whole year, abundant from June to November, or, along the coast, to the end of the year.

Pteropoda.

Limacina balea Möller. — A. North Sea: *November:* W. of Hanstholm to 57° N. 3° E. — B. The Skagerak: very common in September, rare in October, common in November (30. XI.).

Zoantharia.

Arachnachtis albida M. Sars. — See page 8.

Ciliata.

Cyttarocylis denticulata Ehb. *s. l.* — The difficulty of distinguishing between the new, nearly related, species of Brandt and Ostenfeld has induced me to retain the old name. All the new species are nearly connected and have the same distribution, or belong exclusively to the western and northern Atlantic and to the Arctic Sea.

North Sea: *March:* rare on some spots in the chæto-region. *June:* common between the Shetlands and Norway. — The Skagerak: rare from January to May; rare in December.

Cyttarocylis Claparedii v. DADAY. — As constituting this species I consider the form given in fig. 1. — Rare in September at Plymouth and Helder.

Dictyocysta elegans EHB. — Rare in *March* at 61° 32′ N. 2° 13′ E. and the 31. I. in the Skagerak.

Ptychocylis acuta BRANDT (or *Tintinnus urnula* AUCT.). — North Sea: *March:* between the south of Norway and Skagen, rare. *November:* rare E. of Newcastle. — Skagerak: rare from January to March, not rare in *November* and *December*.

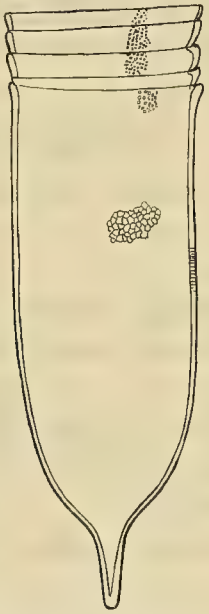

Fig. 1. *Cyttarocylis Claparèdii* v. DAD. 225 t. m.

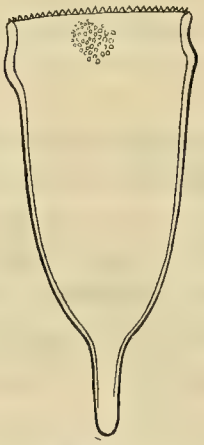

Fig. 2. *Ptychocylis Ehrenbergii* CLAP. & LACHM. 225 t. m.

P. Ehrenbergii CL. & LACHM.? — I am unable to decide what form is represented by the published figures. I believe the annexed fig. 2 represents what is understood as *Tintinnus Ehrenbergii*, but it may perhaps also represent what some authors name *Tint. serratus*. In all cases what I here name P. Ehrenbergii is an easily recognized neritic species. It occurs abundantly in August and September at Plymouth, and from September to December sparingly at Helder.

T. beroidea var. acuminata v. DADAY. — North Sea: rare in March at 55° N. 6° W. Helder: rare in June, more or less scarce from September to December. The E. Channel: Plymouth: rare in February to April, less rare in November, December. S:t Vaast: not rare in August, rare in December. The Skagerak: rare in January, April and May, November and December.

Tintinnopsis campanula EHB., in which species I include *T. campanella* v. DADAY and *T. cinctus* CL. & LACHM., which seem to me to be the young states only. *T. campanella* HKL. is perhaps another species.

North Sea. *July:* rare west of the Danish Peninsula. *November:* not rare on the coast, north of Holland and Germany. — The E. Channel. Plymouth: more or less scarce in August and September. S:t Vaast: rare in August, common in September, rare in November. — Helder: rare in July, not rare in September, rare in October and November. — The Skagerak: from July increasing in abundancy until November.

T. fistularis Moebius (= *T. Helix* Clap. & Lachm.?), — As representing this species I consider the annexed (fig. 3). The membrane is finely and irregularly punctate and the rings variable in height and number. It occurs at the end of October in the Skagerak and at Måseskär.

T. ventricosa Clap. & Lachm. — The E. Channel in November. Plymouth: rare in January and March. S:t Vaast la Hogue from August to December, maximum in September. — Helder: August to November, maximum in September. — The Skagerak: rare in January and in March, maximum in October, November.

Fig. 3. *Tintinnopsis fistularis* Moeb. 225 t. m.

Fig. 4. *Tintinnopsis Lobiancoi* v. Dad. 225 t. m.

T. Lobiancoi v. Dad. — I suppose the annexed fig. (4) may represent this species, but have some doubts whether it may not be *T. Karajacensis* Brandt. It was found rarely at Helder in August and September, both in 1897 and 1898.

Tintinnus minutus Brandt. — This arctic form was seen sparingly in June, east of Stadt in Norway.

T. secatus Brandt. — The Skagerak: very rare in January and in November, December.

T. Steenstrupii Cl. & Lachm. — The Skagerak from October to December.

T. subulatus Ehrb. — The Skagerak from August to November.

Radiolaria.

Acanthochiasma fusiforme Hkl. — Rare in *November:* NE. of Scotland and E. of Newcastle. In the SW. of Norway. — Plymouth: rare in January, common in August, rare in October. — The Skagerak: very rare in December.

Acanthonia Mülleri Hkl. — North Sea very rare in November between Scotland and the Orkneys.

Acanthometron fuscum Müll. — Very rare in the Skagerak, January (31st) and February (1st).

A. elasticum Hkl. — Very rare in June W. of Stadt in Norway.

A. quadrifolium Hkl. (incl. *A. catervatum* and *Acanthostauros pallidus*). — North Sea: *March:* in the company of *Halosphæra* not rare in several spots from the N. and E. of Scotland to the W. of Norway (63° 1′ N. 1° 36′ E.) and in the chæto region to the Skagerak. Also above the depression south of Dogger bank. November: rare, together with Halosphæra, from the N. of Scotland to the S. of Norway and the Skagerak. — The Skagerak: rare in September, October.

Dictyocha fibula Ehb. — Plymouth: rare in August. In November rare W. of Jutland. The Skagerak: rare in January and in November, December.

Gazelletta hexanema Hkl. — In November very rare S. of the Orkneys.

Litholophus ligurinus Hkl. — Very rare W. of Stadt (Norway) in June.

Plectophora arachnoides (Clap & Lachm.). — *March:* rare at Skagen. *November:* rare N. of Scotland and above the Fisher Bank. — The Skagerak, very rare in January, February.

Rhizopoda.

Globigerina bulloides d'Orb. — Rare in March at 58° 21′ N. 1° 40′ E. and at 58° 40′ N. 4° 18′ E.

Cystoflagellata.

Noctiluca miliaris Surir. — The E. Channel: at Plymouth common from the end of June to the end of July, rare in September, common from October to December. Southern North Sea: abundant in *June* from the E. Channel to the NW. of Heligoland. *July* to *September:* common from the E. Channel to the coast of Holland, rare from September to November. The Skagerak, rare in December.

Silicoflagellata.

Distephanus speculum (Ehb). — Rare in *March* at the Fisher Bank, in *August* at Plymouth and in *November* in the E. Channel, at Helder and west of the Danish Peninsula. Rare in the Skagerak in *October* and *November*.

Chlorophyllaceæ.

Halosphæra viridis Schmitz. — A. The North Sea: abundant in *March* from 63° N. 1° 30′ E. to Stavanger, sparingly from Stavanger to Skagen and to Newcastle. *November:* at the Hebrides. Between the N. of Scotland, Newcastle and Skagen. — B. The E. Channel: rare in August and September at Plymouth. — C. The Skagerak: in *January*, *February* and *November*, *December*.

Dinoflagellatæ.

Ceratium furca Duj. — North Sea: follows as a rule C. tripos, but rarer. The Skagerak: common in *January*, more or less rare the whole year.

C. fusus Duj. — North Sea: follows C. tripos but rarer. The Skagerak: the whole year, seems to be more abundant from August to the end of the year. — Plymouth: the whole year, maximum in *April*.

C. lineatum Ehb. The Skagerak: rare almost the whole year, maximum probably from *August* to *November*.

C. macroceros Ehb. — A. The North Sea. *March:* more or less rare in the chæto region from Scotland to Norway and Skagen. *June:* common W. of Skagen to half way between Skagen and Newcastle. Not rare E. of Firth of Tay. *July*, *August:* very common W. of Skagen and the Danish Peninsula. *November:* very rare W. of Scotland, common from the S. of the Orkneys towards Newcastle and to 53° N. 4′ E., thence to Skagen and S. Norway. — B. The Skagerak: more or less rare until July, later common until the end of the year.

C. tripos Nitzsch. — A. The North Sea. *March:* common in the eastern part, SW. of Norway, W. of Skagen and the Danish Peninsula towards 55° N. Common also at 53° 26′ N. 3° 57′ E. *June:* from Skagen to 1° E., between 56° 30′ and 57° 30′ N. *July*, *August:* from Skagen to 57° N. 4° E. and to 55° 30′ N. 7° 30′ E. (no observations from the western North Sea). *November:* the whole North Sea from Scotland to Norway, Skagen and to 53° N. 4° E. — B. The E. Channel: the whole year at Plymouth, maximum from *July* to *December*. — C. The Skagerak: common in *January*, then rare to *June*, common from *July* to the end of the year.

C. tripos var. longipes Bail. — A. The North Sea. *March:* more or less scattered over the *chæto region*, from Scotland to Norway, Skagen and the W. of the Danish Peninsula. *June:* abundant W. of the Hebrides, E. of Firth of Tay (56° 30′ N. 0° 38′ E.) and at 55° 25′ N. 0° 8′ E., less abundant W. of Skagen and above the Fisher Bank. *July, August:* sparingly W. of the Danish Peninsula (observations incomplete). *November:* almost absent from the North Sea, but common at Helder in November and December. — B. In the E. Channel: at Plymouth rare in March, April, not rare in June, July and in December. — C. In the Skagerak: as a rule rare from January to June and from September to the end of the year.

C. tripos v. bucephala Cl. A. In the North Sea: rare in *March* on some spots (at 57° N. 6° E., 56° N. 1° E. and 55° N. 1° E.), not seen in June and August. In *November* not rare, sometimes common, round Scotland and between Scotland, Norway and Skagen, rare at 53° N. 4° E. and 55° N. 5° 30′ E. — In the Skagerak rare in January and from *August* to *December*.

C. platycorne v. Daday (= *C. trip. v. aurita* Cl.). — Very rare in November at Plymouth (drifted from the region of the Azores).

Dinophysis acuta Ehrb. — In the North Sea as a rule rare, in *March* and *June* at some spots in the eastern region, in *November* at several points between Newcastle and Skagen. In the Skagerak rare from January to March, in June and July and from October to the end of the year.

Diplopsalis lenticula Bergh. — In *June* rare N. of Holland, in November E. of Scotland. At Plymouth rare from January to August. In the Skagerak rare in July and in October.

Gonyaulax spinifera Clap. & Lachm. — Rare in March in the North Sea (at 56° N. 0° and 55° N. 1° W.). In the Skagerak common in January, not rare in November, December.

Peridinium depressum Bail. — A. In the North Sea more or less rare in *June* in the eastern part, common NW. of Heligoland and W. of Skagen. In *July, August*, more or less common N. of Holland and on the Fisher Bank. In *November* more or less rare at several points between the N. of Scotland, S. Norway and Skagen. In the Skagerak more or less rare from January to June, less rare in October, December.

P. divergens Ehb. — In the North Sea as a rule rare among the tripos-plankton. In the Skagerak rare in January, less rare from July to October.

P. Michaëlis Ehb. — Rare in April at Plymouth, in June W. of Schleswig, in October at Måseskär.

P. oblongum Auriv. (= *P. diverg. v. obl.* Aur. and *P. div. v. oceanica* Vanh. Ostenf.). Rare in June in the E. Channel at S:t Vaast, in July at Helder, in the Skagerak and at Måseskär.

P. ovatum POUCHET. — Rare in January off the Swedish west coast, in June W. of Cape Stadt and in the E. Channel, in July in the Skagerak, in August at Plymouth, September to November at Helder.

Pyrophacus horologium STEIN. — In *March* at 53° N. 4° E., in *April* very rare at Plymouth, in *June* NW. of Hanstholm, in *November* S. of the Orkneys, ENE. of Newcastle (55° 35′ N. 0° 34′ E.) and at 56° N. 9° E.

Pyrophacus horologium belongs to the tropical Atlantic (also the Indian Ocean) or to the desmo- and styli-plankton, where it has considerably greater size than in the North Sea, when among the tripos-plankton.

Flagellatæ.

Phæocystis Pouchetii LAGERH. — At Helder very abundant in April and May, rare in June, common in August and not rare in October. — At S:t Vaast la Hogue common in June, also in December. — At Plymouth common from the beginning of April to the beginning of June, rare in September.

Cystæ.

Xanthidium Hystrix CL. — Rare in the Skagerak in March, October and November.

By the above name I denote an organism, which belongs to the tripos-plankton and seems to be nearly akin to *X. brachiolatum* MOEBIUS, from which it differs by longer, usually not divided, spines. Probably a stage in the development of some dinoflagellate.

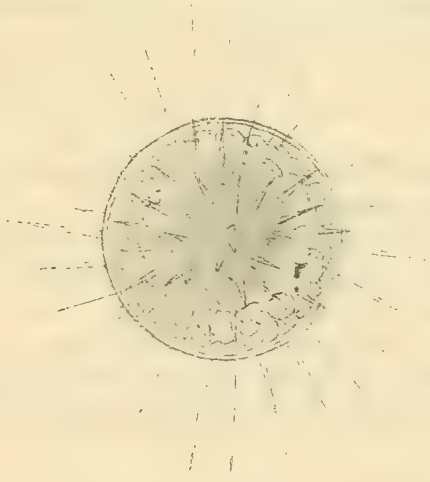

Fig. 5. *Xanthidium hystrix* CL. 500 t. m.

X. multispinosum MOEBIUS. — In April at Måseskär, in June at Plymouth, in July at Måseskär, September, October in the Skagerak, always rare.

Hexasterias problematica Cl. — By this name I denote provisionally a unicellular alga, which I have found in several collections. It is a flat disc, diameter 0,04 mm., with six, at the ends truncate and denticulate empty processes, twice as long as the radius of the disc. Having seen only specimens preserved in spirit I am unable to decide whether the chromatophores are yellow or green.

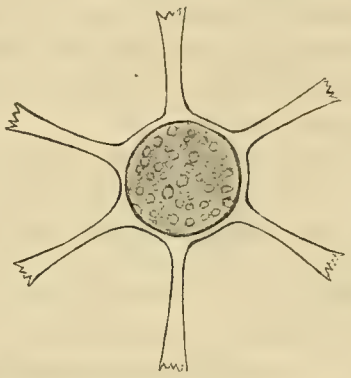

Fig. 6. *Hexasterias problematica* Cl. 500 t. m.

Habitat: Helder, rare in December. Outside the North Sea at the following points: Iceland (Westmannaö 26. X. 98), the Färöes (23. VII. 98), at 51° N. 2° 5′ W. (14. XI. 98), at 66° 30′ N. 22° 30′ W. (29. V. 99) and at 61° 37′ N. 6° 40′ W. (20. V. 99).

Diatomaceæ.

Asterionella japonica Cl. (in Cl. & Möll. Diat. N:o 307, 1882. *A. glacialis* Ostenf. probably Castrac. 1886 *A. spathulifera* Cl.). — At Plymouth in March and April, rather rare in September. Very rare in the Skagerak on the 31st of January.

Asteromphalus heptactis Ralfs. — Very rare in March at 63° 1′ N. 1° 36′ E.

Bacteriastrum delicatulum Cl. — Very rare in June W. of Stadt in Norway.

B. varians Lauder. — In March at Plymouth, in July, August NW. of Heligoland. At Helder common in August, September, rare in October. At S:t Vaast la Hogue more or less sparingly in November, December.

Bellerochea malleus Btw. — In March very rare W. of Jutland (55° 43′ N. 7° 29′ E.). In November at S:t Vaast la Hogue, from the Channel to the coasts of Holland, at Helder and in the Skagerak.

Biddulphia aurita Lyngb. — In *March* on the whole sparingly round the south coast of Norway, at Skagen, on the Fisher Bank and above the depression S. of the Dogger Bank. — At Helder rare in February. In the Skagerak from January to March. In November common at Helder, rarer in the Skagerak and at S:t Vaast la Hogue.

B. mobilensis Bail. — A. In the North Sea, in *March* more or less abundant round Scotland, between the Shetlands and Cape Stadt, above the Fisher Bank. Common above the depression S. of Dogger Bank. In *November* common from the E. Channel to the W. of Jutland. — B. In the E. Channel at Plymouth more or less abundant from January to April, rarer in October—December, at S:t Vaast la Hogue rare in November. — C. In the Skagerak in January and in October—December.

Cerataulina Bergonii H. Per. — A. In the North Sea rare in March about 57° N. 6° E., rare in June at about 62° N. 2° 30′ E. and 57° N. 9° E. — B. In the E. Channel rare at Plymouth in March, less rare in April and June, rare in November at; S:t Vaast la Hogue rare from June to August. — C. At Helder more or less common from the end of April to the beginning of June, rare in November. — D. In the Skagerak rare in January, more or less common from June to the end of the year, maximum in June and in October.

Chætoceros anastomosans Grun. — Very rare in August at Helder, in the Skagerak in October.

C. atlanticus Cl. — In *March* rare at some spots SW. of Norway and W. of Jutland, in *June* rare W. of Cape Stadt and mid-way between Scotland and Norway.

C. borealis Btw. — A. In the North Sea rare and scattered in *March* through the chæto region, maximum at 57° N. 6° E. In *June* E. of Firth of Tay abundant; less common W. of Jütland. — B. In the Skagerak more or less rare from January to June, more abundant from October to December.

Var. Brightwellii Cl. — In the North Sea rare in *March* at some spots in the chæto region from 56° N. 4° E. to Skagen. In the Skagerak rare from January to March and in November.

C. constrictus Gran. — In *March* common at Skagen and on some points S. of Norway, rare at Plymouth. — In the Skagerak from January to June, maximum in *March*, at Måseskär from March to the middle of June. More or less common in *October*, *November*.

C. contortus Schütt. — More or less sparingly in July, August at S:t Vaast la Hogue, in September at Helder, in the Skagerak from the end of August to December, and from January to June, maximum in *March* and *June*.

C. coronatus Gran. — Rare in August at Helder, in the Skagerak in October and November.

C. criophilus Castr. — Rare in March on some spots SW. of Norway, in January in the Skagerak.

C. curvisetus Cl. — In the North Sea: more or less sparingly in *March* SW. of Norway, at Skagen and W. of Jutland, in *November* rare W. of Jutland. — In the E. Channel at Plymouth more or less common in *March*, very abundant in August, September, at S:t Vaast la Hogue very abundant in October, November, at Helder rare in September. — In the Skagerak more or less rare from January to April, very common from August to November.

C. densus Cl. (= *C. borealis v. densa* Cl.). — In *March* not rare on the Fisher Bank. In *June* E. of Firth of Tay and more or less abundant from the mouth of the Schelde to Schleswig. At Helder rare in June and not rare from August to December. In the E. Channel at Plymouth more or less abundant from the end of March to the end of April, common in July, August, rarer in September. S:t Vaast la Hogue in June and from October to December. In the Skagerak rare in the beginning of October.

C. danicus Cl. — In the E. Channel at S:t Vaast la Hogue rare in July, at Plymouth not rare in September. At Helder in November and December. In the Skagerak from March to June, maximum in *June*, and from the end of *October* to *December*.

C. debilis Cl. — In the North Sea in *March* SW. and S. of Norway, common at Skagen, in *June* E. of Firth of Tay. — At Plymouth rare in April, at Helder common from October to December. — In the Skagerak in *January* to *June* (maximum in *March*), rarer in October, November.

C. decipiens Cl. — A. In the North Sea. In *March* from Skagen to the W. of Stavanger and 58° N. 1° 30′ E., along 55°—56° N. from the Danish Peninsula to the E. of Firth of Tay and Newcastle. At the spot 53° 30′ N. 3° 40′ E. In *June* at one spot between Norway and the Shetlands. West of Jutland 66° N., in *November* very sparingly from the E. Channel to Jutland. — B. In the E. Channel at Plymouth more or less sparingly from January to March, common in October, November, later rare. At S:t Vaast la Hogue very abundant in June, rare in October and December. — In the Skagerak January to June (very abundant in *March*), more or less rare in October, November.

C. diadema Ehb. — Rare in *March* SW. of Norway. At Plymouth rare at the end of September, at Helder rare in December. In the Skagerak from January to May (abundant in *March*) and very common in *November*.

C. didymus Ehb. — A. In the North Sea in *March* rare along the SW. and S. coast of Norway, at Skagen and W. of Jutland. In *June* NW. of Heligoland. In *November* very rare from the E. Channel to the W. of Jutland. At Helder rare from August to the end of November. — B. In the E. Channel: at Plymouth rare in March and in October, common in November. At S:t Vaast la Hogue common in June and July, rare in August, more or less sparingly from the end of October to the end of December. — In the Skagerak rare from January to March, more or less abundant from the end of August to December, maximum *September*, *October*.

[**C. Granii** Cl., mentioned in my paper »Plankton Researches in 1897», was not seen in 1898. This species, represented in the annexed figg. 7 and 8, forms loose chains of rectangular, thin-walled cellules (longit.: sagittal axis = 1:2). Foramina large, elongate hexagonal, smaller than the cellules. Awns arising from the angles of the cellules, sagittal and obliquely transverse. Their basal part $^1/_3$ as long as the longitudinal axis. The cellcontents seem to contain one parietal plate. Endocysts biconvex, in transverse sagittal section elliptical, covered with numerous simple spines. Sagittal axis 0,013 to 0,015 mm. — Måseskär in March 1897.]

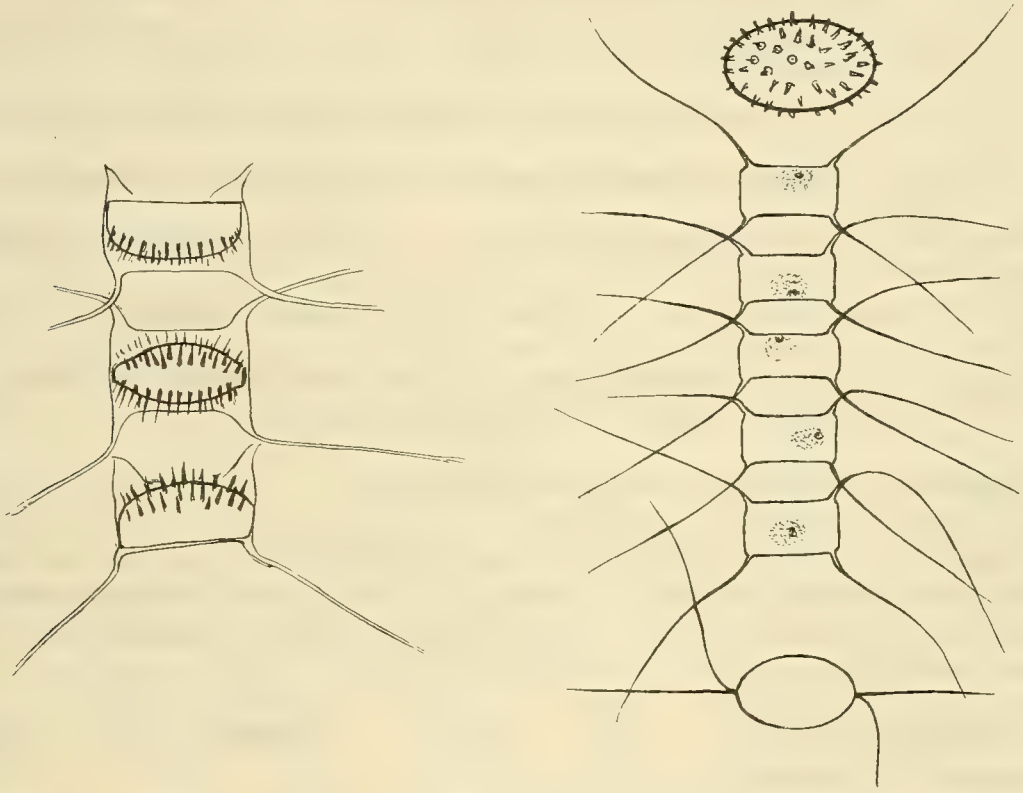

Fig. 7, 8. *Chætoceros Granii* Cl. 1000 t. m.

C. hiemalis Cl. — In June rare E. of Firth of Tay and common W. of Skagen. In the Skagerak from the end of March to June more or less abundant, and in October, November.

The annexed fig. 9 represents the endocysts 500 t. magnified. They resemble those of *C. laciniosus.*

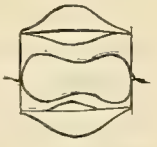

Fig. 9.

C. laciniosus Schütt. — Rare in the Skagerak, January—March, less rare in *November.*

C. Schüttii Cl. follows as a rule *C. curvisetus* and *C. didymus.* — A. In the North Sea rare in *March* at the Fisher Bank, in *June* W. of Cape Stadt, in *November*

W. of Jutland. — B. In the E. Channel at Plymouth rare in February, March, abundant in *July*, *August* and in *November*. At S:t Vaast la Hogue rare in August. — C. At Helder rare from the end of September to the end of October. — D. In the Skagerak rare in January, common from October to the middle of *November* (maximum in the beginning of November) or along the coast from the end of August (maximum in *September*).

Fig. 10.

C. scolopendra Cl. — In *March* rare SW. of Norway and midway between Skagen and Scotland. — At Helder rare at the end of September. In the Skagerak rare from January to April and in November.

The annexed fig. 10 represents the endocyst, 1000 t. m.

C. seiracanthus Gran. — Rare in the Skagerak, at the end of October.

C. septentrionalis Oestr. — Rare in the Skagerak in March.

C. similis Cl. — Rare in the Skagerak in March and in November.

C. socialis Lauder. — Rare from January to March in the Skagerak, in March on the Fisher Bank.

C. subtilis Cl. — Rare in March in the Skagerak.

C. teres Cl. — In the North Sea rare in March SW. of Norway, at Skagen, on the Fisher Bank and at 56° 34′ N. 2° 20′ E. — At S:t Vaast la Hogue rare in June (appeared again in January 1899). — In the Skagerak from January to March and in *November*, usually rare.

C. Weissflogii Schütt. — In the Skagerak in September, on the 3rd of that month common at Måseskär.

C. Villei Gran. — Rare in June at Helder.

Corethron hystrix Hensen. — Rare in June W. of Cape Stadt.

Coscinodiscus concinnus W. Sm. — A. In the North Sea found abundantly in *March* from Skagen along the Danish coast to 55° N. More or less sparingly from the Danish Peninsula, along 56° N., towards Edinburgh and Newcastle. *June* to *August* rare in some spots. In *November* common from the E. Channel to Skagen and from Skagen along 56°—57° N. to 4° E. — B. In the E. Channel at Plymouth common from January to May and from the end of September to the middle of December. — C. At Helder rare in January, February, more or less common from the end of September to the end of December. — D. In the Skagerak more or less sparingly from January to March and from the end of August to December (maximum in *December*).

C. excentricus EHB. — In *November* more or less rare in the SE. region. At Helder rare in January, not rare in November, December. At Plymouth in January, February and in November. In the Skagerak in November and December.

C. oculus iridis EHB. — In the North Sea in March, as a rule in the company of *Halosphæra*, W. of Norway and sparingly scattered through the *chæto region*. In November rare W. of Jutland. At S:t Vaast la Hogue rare in November, at Helder in November, December. In the Skagerak rare from January to March and in November.

C. polychordus GRAN. — Rare in March E. of Newcastle and W. of the Fisher Bank. In the Skagerak rare from January to April and in November.

C. stellaris ROPER. — In the Skagerak rare from January to March.

Dactyliosolen antarcticus CASTR. — Rare in June W. of Cape Stadt.

Ditylum Brightwellii WEST. — A. In the North Sea in *March* common W. of Jutland at 55° 30′ N. 6° 10′ E., rare above the northern edge of the 50 metre plateau. — B. In the E. Channel at Plymouth rare in January, February, very common in September; at S:t Vaast la Hogue rare in December. — C. At Helder more or less rare in November, December. — D. In the Skagerak rare from January to March and from October to the end of November.

Eucampia zodiacus EHB. — A. In the North Sea rare in *March* at 55° 30′ N. 6° 10′ E. In *June* not rare N. of Holland and W. of Schleswig. In *November* sparingly from the E. Channel to the W. of Jutland. — B. In the E. Channel at Plymouth common in April, rare from the end of *September* to the beginning of *December*. At S:t Vaast la Hogue rare in July, August, October and December. — C. At Helder more or less abundant from the beginning of May to the middle of June and from the end of September (very common) to the end of November (rare). — D. In the Skagerak rare in January and in October, November.

Guinardia flaccida CASTR. — In the North Sea in *March* rare at Skagen and not rare above the Fisher Bank, in *June* from the E. Channel to Skagen, most abundant W. of Holland, in *July* not common W. of the Danish Peninsula, in *November* not rare from the E. Channel to Skagen. — B. In the E. Channel, at Plymouth rare in March, not rare in August, September and October, at S:t Vaast la Hogue rare in June, very common from July to August. — C. At Helder common from the end of May to the end of September. — D. In the Skagerak from *July* to *December* (maximum in *November*).

Lauderia annulata CL. — A. In the North Sea rare in *March* on the Fisher Bank, in *June* E. of Firth of Tay and more or less rare from the N. of Holland to Skagen, in *November* rare near the E. Channel. — B. In the E. Channel at Plymouth rare in January, more or less common in March, April and rare in September. — C. At Helder rare from the end of October to December. — D. In the Skagerak rare in January, March and November.

Leptocylindrus danicus Cl. — A. In the North Sea in *March* rare S. and SW. of Norway and at Skagen, in June rare at Skagen. — B. In the E. Channel at Plymouth not rare in August, September and at S:t Vaast in July, August. — C. In the Skagerak more or less scarce from the middle of February to the beginning of June, rare in November.

Lithodesmium undulatum Ehb. — At Helder more or less rare from the end of October to the end of December, east of the E. Channel in November.

Navicula membranacea Cl. — Rare in the E. Channel in November.

Nitzschia seriata Cl. (including *N. fraudulenta* Cl.). — In *March* more or less rare S. and SW. of Norway, in June W. of Skagen. — In the Skagerak more or less rare from February to the middle of June and very rare in November.

Rhizosolenia alata Btw. — Not rare in November W. of Hanstholm. At Plymouth in September and November.

Var. corpulenta Cl. — Rare at Plymouth from August to December.

Var. gracillima Cl. — A. In the North Sea. *June* W. of Skagen, abundant. *July, August* W. of Skagen and on the Fisher Bank. *November* rare N. of Skagen. — B. In the E. Channel at Plymouth more or less sparingly from the end of March to July, very common in July and August. — C. In the Skagerak enormously abundant from June to the end of July, then rarer until December. Appears at Måseskär as early as the end of April.

R. calcar avis Schultze. — From July to November rare W. of the Danish Peninsula. At Helder from the end of September to the end of November. In the Skagerak rare in October and December.

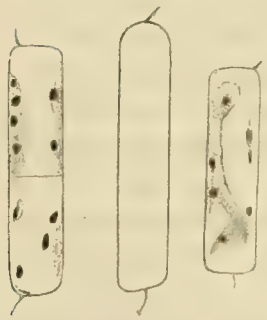

Fig. 11.

R. delicatula Cl. N. sp. — At S:t Vaast la Hogue rare in April and in November, at Helder in August and September, in the Skagerak common in the first half of June, rare in September and November.

The annexed figures (11) represent three specimens in different positions, 500 times magnified. Cells cylindrical, straight, 4 to 5 times longer than broad, extremely thin-walled, without distinct transverse rings. Their ends slightly and irregularly convex with a short, excentric spine. Length 0,05 to 0,07 mm. Breadth 0,0014 mm.

R. obtusa Hensen. — Rare in February at Måseskär.

R. robusta Btw. — Rare at Plymouth in March, April and September, more or less common in *October, November, December.* — In November from the E. Channel to the mouth of Schelde.

R. semispina Hensen. — A. In the North Sea in *March* rare E. of Firth of Tay and SW. and S. of Norway, in *June* rare between the Shetlands and Cape Stadt, W. of Skagen, E. of Firth of Tay — In the E. Channel rare at Plymouth in April, May. — In the Skagerak more or less rare from January to June, rare in November.

R. setigera Btw. — At Helder rare in June and from September to the end of December, in the Skagerak rare from January to April and from October to the end of the year.

R. Shrubsolei Cl. — A. In the North Sea in *June* rare E. of Firth of Tay, more or less rare N. of Holland. In *July, August* rare off the coast of Holland. — B. In the E. Channel at Plymouth rare in January and March, common in April, rare in August. At S:t Vaast la Hogue, very abundant from the middle of June to the middle of August, rare from October to December. — C. At Helder more or less common from the middle of May to November. — D. In the Skagerak more or less rare in July and in the first days of October.

R. Stolterfothii H. Per. — A. In the North Sea in *March* rare at the border of the Fisher Bank. *June:* rare to the north of the Dutch coast. *November:* common near the E. Channel. — B. In the E. Channel at Plymouth rare in March, common from April to the end of June, rare in August, September. At S:t Vaast la Hogue rare from June to August, very common from the end of October to the end of December. — C. At Helder rare in May, June and in November, December. — D. In the Skagerak in September and October, rare.

R. styliformis Btw. — A. In the North Sea in *March* as a rule sparingly from Hanstholm along the Danish coast to about 60° N. and above the Fisher Bank; along the northern border of the Dogger Bank as well as SE. of the Dogger Bank or, practically, along the border of the 50 metre plateau. In *June* from Holland along the Danish coast to Hirthals. In *July* and *August* sparingly at 54°—54° 30′ N. 5° 40′—8° E. In *November* from Skagen along the Danish coast to 55° 30′ N. and above the Fisher Bank. — B. In the E. Channel at Plymouth more or less rare from the end of March to the end of November. — C. At Helder very rare at the end of October and in the middle of November. — D. In the Skagerak rare in January, June and from the middle of September to December.

Skeletonema costatum Grev. — At Plymouth common in March and very common at the beginning of August, later rare. In the Skagerak rare from January to May, common from the beginning of *November*.

Stephanopyxis turgida Grev. — In the North Sea in *June* together with *Rhizosolenia styliformis* between the German and Danish coasts, in *November* very rare W. of Skagen. — At Plymouth rare in April. — In the Skagerak rare in January, September and October.

Streptotheca thamesis Shrubs. — From January to March rare at Plymouth, in *March* W. of Scotland and midway between Scotland and Norway, in *November* common in the E. Channel and sparingly along the Dutch coast to about 56° N. 6° E.

Thalassiosira gelatinosa Hensen. — In the Skagerak rare from January to the beginning of April and in November. Rare in December at Helder.

T. gravida Cl. — In the Skagerak rare from February to the end of April and in December. At S:t Vaast la Hogue in December. — In the North Sea rare in March on the Fisher Bank.

T. Nordenskiöldii Cl. — From January to March rare (at Måseskär common from 9. II. to 21. III.) in the Skagerak. In March rare S. and SW. of Norway and at Skagen. In November rare in the Skagerak.

Thalassiothrix Frauenfeldii Grun. — A. In the North Sea in *March* abundant S. and SW. of Norway and at Skagen, in *June* not rare at Hanstholm. — B. In the Skagerak from January to June, very abundant in March, and very common in November, December.

T. longissima Cl. & Grun. — A. In the North Sea in *March* rare S. and SW. of Norway and at Skagen, in *November* rare at 58° 12′ N. 5° 30′ E. — B. In the Skagerak rare from January to April (common at Måseskär from the 9th to the 15th of February).

An Attempt to classify the Plankton-organisms according to their Geographical and Seasonal Distribution.

Although the exploration of the North Sea in 1898 has been carried out four times only and the data are by no means complete, I venture to classify the plankton-organisms according to their distribution at different seasons. This classification may be in some cases erroneous, for want of sufficient data, but as a rule I consider it correct and in all cases useful as a starting point and basis for future researches. The organisms may be classified as follows.

A. **Forms that, as a rule, are confined to the space above the 50 metre plateau on the bottom.**

1. The whole year: *Corycæus anglicus.*
2. From March to June: *Cerataulina Bergonii*, *Ditylum Brightwellii* (also in November and December).

3. From April to October: *Phæocystis Pouchetii.*

4. From May to November, December: *Eucampia zodiacus, Guinardia flaccida, Rhizosolenia Shrubsolei* and *R. Stolterfothii.*

5. In June: *Chætoceros Villei, Stephanopyxis turgida.*

6. From June to November, December: *Centropages hamatus, Tintinnopsis beroidea var. acuminata, Chætoceros densus, Lauderia annulata, Rhizosolenia setigera, R. styliformis.*

7. From July, August: *Oikopleura dioica, Proto pedata, Paracalanus parvus, Tintinnopsis campanula, T. ventricosa, Noctiluca miliaris, Bacteriastrum varians, Chætoceros anastomosans, C. coronatus, C. didymus, C. curvisetus, Rhizosolenia delicatula.*

8. From September: *Ptychocylis Claparèdii, P. Ehrenbergii.*

9. From October, November: *Acartia bifilosa, Euterpe acutifrons, Bellerochea malleus, Chætoceros danicus, C. Schüttii, Lithodesmium undulatum, Rhizosolenia calcar avis, R. robusta.*

All these forms are, with the exception of *Phæocystis Pouchetii*, of southern habitat.

B. **Forms that, as a rule, are confined to the space above the 100 metre plateau.**

1. Spring-forms, or such as occur in March:

Southern forms:	Northern forms:
Microsetella atlantica,	*Metridia hibernica,*
Oithona similis,	*Ceratium longipes,*
Acanthometron quadrifolium,	*Chætoceros borealis,*
Halosphæra viridis.	*v. Brightwellii.*

2. Summer-forms, or such as occur in June, July, August:

Southern:	Northern:
Evadne spinifera,	*Evadne Nordmannii,*
Ceratium tripos,	*Acartia longiremis,*
C. macroceros.	(*Metridia hibernica*).

3. Autumn-forms, or such as occur in October:
Centropages typicus (southern).

4. Winter-forms, or such as occur in November:

Southern:	Northern:
(*Acanthometron quadrifolium*),	(*Calanus finmarchicus*),
(*Halosphæra viridis*),	*Limacina balea,*
Ceratium tripos v. bucephala.	*Dinophysis acuta.*

The parentheses denote that the enclosed species also occur in the spring.

C. **Forms that occur in the spring above the 100 metre plateau and in the summer or autumn above the 50 metre plateau.**

1. Occurring in the summer above the 50 metre plateau:

Southern:	Northern:
Acartia Clausii,	*Acartia longiremis,*
Oithona similis,	*Pseudocalanus elongatus,*
Sagitta bipunctata.	*Temora longicornis.*

2. Occurring in the winter above the 50 metre plateau:

Southern:	Northern:
Biddulphia mobilensis,	*Chætoceros decipiens,*
Coscinodiscus concinnus,	*C. diadema.*
Streptotheca thamesis.	

Those of the 1st group have probably migrated from the north towards the south. The forms of the 2nd group arrived probably through the E. Channel.

D. **Forms, which occur chiefly in the eastern part of the North Sea.**

1. Winter and spring:

Fritillaria borealis,
Parathemisto oblivia,
Biddulphia aurita,
Chætoceros atlanticus,
C. constrictus,
C. criophilus,
C. curvisetus,
C. scolopendra,
C. socialis,
C. teres.
Coscinodiscus oculus iridis,
Leptocylindrus danicus,
Nitzschia seriata,
Thalassiosira Nordenskiöldii,
Thalassiothrix Frauenfeldii,
T. longissima.

All, with the exception of *Chætoceros curvisetus,* are northern species and it may be assumed that they arrived in the winter through the deep Norwegian fissure or in the spring from the Skagerak.

2. Summer:

Acanthometron elasticum,
Litholophus ligurinus,
Bacteriastrum delicatulum.

All are southern. There was found also *Tintinnus minutus,* which belongs to arctic regions.

Remarks to the tables.

In order to reduce the size of the tables the rarer forms have been excluded. The tables are thus to be completed by the following additional notes.

Table I.[1]

The North Sea in March.

Anomalocera Patersonii TEMPL. — 11. III. 56°10′N. 6°56′E. *r*.

Candace pectinata BRADY. — 6. III. 56°17′N. 0°20′W. *r*.

Centropages typicus KRÖYER. — 8. III. 57°21′N. 2°27′E. *r*.

Corycæus anglicus LUBBOCK. — 6. III. 54°53′N. 7°40′E. *r* 11. III. 56°52′N. 8°9′E. *r*.

Oithona plumifera BAIRD. — 6. III. 61°32′N. 2°13′E. *r*.

Oncæa minuta GIESBR. — 7. III. 63°1′N. 1°36′E. *rr*.

Cyttarocylis gigantea BRANDT. — 6. III. 56°17′N. 0°20′W. *r*.

Dictyocysta elegans EHB. — 5. III. 61°32′N. 2°13′E. *r*.

Plectophora arachnoides CLAP. & LACHM. — 4. III. 57°46′N. 10°29′E. *r*.

Distephanus speculum EHB. — 5. III. 56°58′ N. 5°44′E. *r*.

Globigerina bulloides D'ORB. — 11. III. 58°21′N. 1°40′E. *r*, 12. III. 58°40′N. 4°18′W. *r*.

Oikopleura dioica FOL. — 4. III. 57°18′N. 8°27′E. + 6. III. 55°43′N. 7°29′E. *r*.

Ceratium lineatum EHB. — 8. III. 58.51′N. 5°9′E. *r*.

Ceratium tripos var. arctica EHB. — 7. III. 63°1′N. 1°36′E. *r*.

var. bucephala CL. — 5. III. 56°58′N. 5°44′E. *r*, 6. III. 55°42′N. 1°5′E. *r*, 6. III. 55°13′N. 0°48′E. *r*.

var. horrida CL. — 6. III. 61°32′N. 2°13′E. *r*, 4. III. 57°18′N. 8°27′E. *r*.

Dinophysis acuta EHB. — 11. III. 55°30′N. 6°10′E. *r*.

Gonyaulax spinifera CLAP. & LACHM. — 9. III. 55°44′N. 0°23′E. *r*, 9. III. 55°12′N. 1°18′W. *r*.

Pyrophacus horologium STEIN. — 10. III. 53°26′N. 3°57′E. *r*.

Asterionella japonica CL. — 12. III. 55°15′ N. 5°45′E. *r*.

Asteromphalus heptactis RALFS. — 7. III. 63°1′N. 1°36′E. *r*.

Bellerochea malleus BTW. — 6. III. 53°26′N. 3°57′E. *r*.

Cerataulina Bergonii H. PER. — 5. III. 56°58′N. 5°44′E. *r*.

Chætoceros contortus SCHÜTT. — 9 III. 57°47′N. 10°37′E. +, 4. III. 57°46′N. 10°29′E. +.

C. criophilus CASTR. — 8. III. 58°28′N. 4°27′E. *r*, 8. III. 57°54′N. 3°26′E. *r*, 11. III. 58°21′N. 1°40′E. *r*.

C. densus CL. — 4. III. 57°18′N. 8°27′E. +.

C. diadema EHB. — 8. III. 58°51′N. 5°9′E. *r*, 11. III. 58°21′N. 1. 40′E. *r*.

C. scolopendra CL. — 8. III. 58°51′N. 5°9′E. *r*, 8. III. 57°21′N. 2°27′E. *r*

C. socialis LAUDER. — 10. III. 57°51′N. 7°47′E. *r*.

Coscinodiscus polychordus GRAN. — 9. III. 55°12′N. 1°18′W. *r*, 5. III. 56°58′N. 5°44′E. *r*.

Eucampia zodiacus EHB. — 11. III. 55°30′N. 6°10′E. *r*.

Guinardia flaccida CASTR. — 9. III. 57°47′N. 10°37′E. *r*, 5. III. 56°58′N. 5°44′E. +, 11. III. 55°30′N. 6°10′E. *r*.

Leptocylindrus danicus CL. — 8. III. 58°51′N. 5°9′E. *r*, 10. III. 57°51′N. 7°47′E. *r*, 4. III. 57°46′N. 10°29′E. *r*.

Nitzschia seriata CL. — 9. III. 57°47′N. 10°37′E. +, 10. III. 57°51′N. 7°47′E. *r*, 4. III. 57°46′N. 10°29′E. *r*.

Rhizosolenia Stolterfothii H. PER. — 4. III. 56°58′N. 5°44′E. *r*.

Streptotheca thamesis SHRUBS. — 11. III. 58°21′N. 1°40′E. *r*, 12. III. 55°15′N. 5°45′E. *rr*.

Thalassiosira gravida CL. — 5. III. 56°58′N. 5°44′E. *r*.

The *Peridinium divergens* and *P. depressum* have been omitted, as probably confounded.

[1] The samples from the line Stavanger to Newcastle have been examined by E. JÖRGENSEN.

Table II.

The North Sea in June 1898.

Centropages typicus KRÖYER. — 9—16. 61°50′ N. 2°30′ E. *r.*
Labidocera Wollastonii LUBBOCK. — 5. 56°1′ N. 1°51′ E. *r.*
Metridia hibernica BRADY & ROBTS. — 4. 56°26′N. 4°1′ E. *r.*
Paracalanus parvus CLAUS. — 5. 53°51′ N. 5°1′ E. *r.* 12. 49°31′ N. 3°29′ E. *r.*
Podon Leuckarti G. O. SARS. — 4. 57°27′N. 7°32′E. *r*, 5. 54°14′ N. 8°2′ E. *r.* 4. 55°46′ N. 7° E. *r.*
Sagitta bipunctata QUOI & GAIM. — 4. 57°9′ N. 5°20′ E. *r.* 4. 56°49′ N. 6°5′ E. *r.*
Cyttarocylis gigantea BRANDT. — 9—16. 61°50′ N. 2°30′ E. *c.* 4. 57°20′ N. 9°10′ E. *rr.*
C. media BRANDT. — 9—16. 61°50′ N. 2°30′E. *rr.*
Tintinnus minutus BRANDT. — 9—16. 61°50′ N. 2°30′ E. *rr.*
Acanthomethron elasticum HKL. — 9—16. 61°50′ N. 2°30′ E. *rr.*
Litholophus ligurinus HKL. — 9—16. 61°50′ N. 2°30′ E. *rr.*
Ceratium lineatum EHB. — 9—16. 61°50′N. 2°30′E. *rr.* 5. 56°12′ N. 1°51′ W. *rr.*
C. tripos var. arctica EHB. — 9—16. 61°50′ N. 2°30′ E. *rr.*
C. tripos var. horrida CL. — 9—16. 61°50′ N. 2°30′ E. *c.* 5. 56°12′ N. 1°51′ W. *r.*
Dinophysis acuta EHB. — 9—16. 61°50′N. 2°30′E. *r.* 5. 54°54′ N. 7°39′ E. *r.*
Diplopsalis lenticula BERGH. — 5. 54°25′N. 5°37′E. + .
Peridinium Michaëlis EHB. — 5. 54°54′ N. 7°39′ E. *r.*
P. ovatum POUCHET. — 9—16. 61°50′ N. 2°30′ E. *r.*
Pyrophacus horologium STEIN. — 5. 56°26 N. 7°55′ E. *r.*
Bacteriastrum delicatulum CL. — 9—16. 61°50′ N. 2°30′ E. *r.*
B. elongatum CL. — 9—16. 61°50′ N. 2°30′ E. *r.*
Chætoceros atlanticus CL. — 9—16. 61°50′N. 2°30′E. *r.* 4. 56°50′ N. 3° E. *r.*
C. danicus CL. — 4. 57°20′ N. 9°10′ E. +.
C. debilis CL. — 5. 56°12′ N. 1°51′ W. *r.*
C. didymus EHB. — 5. 54°14′ N. 8°2′E. *r.*
C. Schüttii CL. — 9—16. 61°50′ N. 2°30′ E. *r.*
Corethron hystrix CASTR. — 9—16. 61°50′N. 2°30′E. *r.*
Coscinodiscus oculus iridis EHB. — 9—16. 61°50′ N. 2°30′ E. *r.*
Dactyliosolen antarcticus CASTR. — 9—16. 61°50′ N. 2°30′ E. *r.*
Leptocylindrus danicus CL. — 4. 57°20′N. 9°10′E. *r.*
Nitzschia seriata CL. — » » » »
Rhizosolenia gracillima CL. — » » » »
R. Shrubsolei CL. — 5. 56°12′ N. 1°51′ W. *r.* 5. 54°25′N. 5°37′E. *r.* 9. 53°16′N. 4°37′E. +.
Thalassiothrix Frauenfeldii GRUN. — 4. 57°20′ N. 9°10′ E. +.

Table III.

The North Sea in July, August.

Corycæus anglicus LUBBOCK. — 2. VIII. 55°28′ N. 6°46′ E. *rr.*
Microsetella atlantica BRADY & ROBTS. — 30. VII. 57°21′N. 4°9′E. *r.* 7. VIII. 56°15′N. 7°50′E. *r.*
Podon Leuckartii G. O. SARS. — 30. VII. 57°32′ N. 7°3′ E. *r.* 30. VII. 57°21′ N. 4°9′ E. *r.*
Bacteriastrum varians LAUDER. — 6. VIII. 54°8′ N. 8°2′ E. *r.*
Coscinodiscus concinnus W. SM. — 6. VIII 54°8′ N. 8°2′ E. *r.* 7. VIII. 56°15′ N. 7°50′ E. *rr.*
Rhizosolenia calcar avis SCHULZE. — 8. VIII. 55°30′N. 7°25′ E. *r.*
R. gracillima CL. — 29. VII. 57°44′ N. 9°37′ E. +. 30. VII. 57°32′ N. 7°3′ E. *r.*
R. styliformis BTW. — 3. VIII. 54°26′ N. 5°43′ E. *r.* 6. VIII. 54°8′ N. 8°2′ E. *r.*

Table IV.

The North Sea in November 1898.

Parathemisto oblivia KRÖYER. — 7. 58°12′N. 5°30′E. *rr.*
Acartia bifilosa LILLJEB. — 13. 50°58′ N. 1°10′ E. *r.* 14. 52°32′N. 13°11′E. *r.* 15. 57°2′N. 8°E. +.
Centropages hamatus LILLJEB. — 13. 51°N. 1°W. *r.*
Metridia hibernica BRADY & ROBTS. — 12. 56°59′N. 5°58′ E. +. 13. 57°3′ N. 7°16′ E. +.
Oithona plumifera BAIRD. — 6. 56°11′N. 2°31′E. +.
Oikopleura dioica FOL. — 14. 52°32′N. 3°11′E. +. 15. 57°2′ N. 8° E. +.
Ptychocylis acuta BRANDT. — 7. 55°1′N. 1°10′W. *r.*
Tintinnopsis ventricosa CLAP. & LACHM. — 13. 51°N. 1°W. *r.* 14. 51°N. 2°5′W. *r.*
Tintinnus Steenstrupii CLAP. & LACHM. — 13. 57°38′N. 9 40′ E. *rr.*
Acanthochiasma fusiforme HKL. — 7. 58°12′ N. 5°30′ E. *rr.* 8. 58°40′N. 1°4′W. *r.* 7. 55°1′N. 1°10′W. *r.*

Acanthonia Mülleri HKL. — 8. 58°53′N. 3°5′W. *rr.* 7. 55°1′N. 1°10′W. +.
Gazelletta hexanema HKL. — 8. 58°53′N. 3°5′W. *rr.*
Dictyocha fibula EHB. — 26. 55°30′N. 7°20′E. *r.* 6. 56°42′N. 4°22′E. *rr.*
Distephanus speculum EHB. — 26. 55°30′N. 7°20′E. *r.* 13. 51°N. 1°W. *r.*
Noctiluca miliaris SUR. — 14. 51°45′N. 2°14′E. +. 15. 54°51′N. 5°36′E. +.
Ceratium tripos var. longipes BAIL. — 8. 58°40′N. 1°4′W. *r.* 8. 58°53′N. 3 5′W. *r.* 26. 56°14′N. 7°39′E. +.
Diplopsalis lenticula BERGH. — 8. 58°40′N. 1°4′W. *rr.*
Chætoceros densus CL. — 13. 50°15′N. 0°30′E. +.
C. didymus EHB. — 14. 51°45′N. 2°14′E. *r.* 15. 55°50′N. 6°47′E. *rr.*
C. Schüttii CL. — 13. 57°3′N. 7°16′E. *r.* 6. 56°42′N. 4°22′E. *r.*
Coscinodiscus oculus iridis EHB. — 15. 56°28′N. 7°46′E. *r.*
Eucampia zodiacus EHB. — 14. 51°45′N. 2°14′E. *r.* 15. 56°28′N. 7°46′E. *rr.*
Lauderia annulata CL. — 14. 51°45 N. 2°14′E. +.
Lithodesmium undulatum EHB. — 14. 51°45′N. 2°14′E. +.
Navicula membranacea CL. — 13. 51°N. 1°W. *r.*
Rhizosolenia alata BTW. — 5. 57°22′N. 8°21′E. +.
R. gracillima CL. — 15. 56°28′N. 7°46′E. *r.*
R. robusta BTW. — 14. 51°45′N. 2°14′E. *r.* 14. 52°32′N. 3°11′E. *r.*
R. Shrubsolei CL. — 14. 51°45′N. 2 14′E. +. 13. 51°N. 1°W. *r.*
R. Stolterfothii H. PER. — 14. 51°45′N. 2°14′E. *c.*
Stephanopyxis turgida GREV. — 5. 57°22′N. 8°21′E. *rr.*
Thalassiothrix longissima CL. & GRUN. — 7. 58°12′N. 5°30′E. *rr.*

Table V.

Helder 1898.

Proto pedata LEACH. — 11. VIII. *rr.*
Acartia bifilosa GIESBR. — 24. XI. *r.*
A. Clausii GIESBR. — 3. XII. *r.*
Pseudocalanus elongatus BOECK. — 10. XII. *r.*
Sagitta bipunctata QUOI & GAIM. — 29. IX. *r.*
Distephanus speculum EHB. — 23. IX. *r*, 11. XI. *r*,
Cyttarocylis Claparedii V. DAD. — 29. IX. *r.*
Tintinnopsis Labiancoi V. DAD. — 11. VIII. *rr.* 29. IX. *rr.*
Ceratium macroceros EHB. — 8. X. *r.*
Peridinium oblongum AUR. — 22. VII. *r.*
Bellerochea malleus BTW. — 29. XI. *r*, 17. XII. *r.*
Chætoceros anastomosans GRUN. — 24. VIII. *r.*
C. contortus SCHÜTT. — 29. IX. *r.*
C. coronatus GRAN. — 11. VIII. *r.*
C. curvisetus CL. — 29. IX. *r.*
C. danicus CL. — 24. XI. *rr*, 21. XII. *r.*
C. diadema EHB. — 17. XII. *rr*, 21. XII. *r.*
C. scolopendra CL. — 29. IX. *rr.*
C. Villei GRAN. — 8, 14. VI. *rr.*
Rhizosolenia styliformis BTW. — 28. X. *rr*, 18. XI. *r.*
Thalassiosira gelatinosa HENSEN. — 21. XII. *r.*

Table VI.

Plymouth 1898.

Microsetella atlantica BRADY & ROBTS. — 16. II. *r.*
Oncæa subtilis GIESBR. — 9. XI. *r.*
Evadne Nordmannii LOVÉN. — 5. VII, 16. VIII, 22. IX. *r.*
E. spinifera P. E. MÜLL. — 23. VI. *r*, 24. VIII. *r.*
Podon intermedius LILLJEB. — 23. VI. *r*, 24. VIII. *r.*
Distephanus speculum EHB. — 16. VIII. *r.*
Dictyocha fibula EHB. — 16. VIII. *r.*
Cyttarocylis Claparèdii V. DAD. — 2. IX. *r.*
Tintinnopsis ventricosa CLAP. & LACHM. — 27. I. *r*, 5. IV. *r.*
Ceratium furca DUJ. — 22. XI. *r.*
C. platycorne V. DAD. — 22. XI. *r.*
Peridinium Michaëlis EHB. — 22. XI. *r.*
P. ovatum POUCH. — 16. VIII. *r.*
Pyrophacus horologium STEIN. — 28. IV. *rr.*
Bacteriastrum varians LAUDER. — 23. III. *r.*
Chætoceros constrictus GRAN. — 23. III. *r.*
C. danicus CL. — 2. IX. *r.*
C. debilis CL. — 14. IV. *r.*
C. diadema EHB. — 22. IX. +.
C. didymus var. longicruris CL. — 2. IX. *r.*
Leptocylindrus danicus. — 16. VIII. +, 2. IX. *r*, 22. IX. +.

Table VII.

Måseskär 1898.

Fritillaria borealis LOHM. — 25. IV. *r.*
Anomalocera Patersonii TEMPL. — 30. I. *r*, 3. IX. +, 1. X. *r.*
Corycæus anglicus LUBB. — 7. IX. *r.*

Metridia hibernica BRADY & ROBTS. — 30. I. *r*.
Temorella affinis POPPE. — 27. V. *r*, 14. XI. *c*.
Podon Leuckartii G. O. SARS. — 27. V. *r*, 4. VI. *r*.
Limacina balea MÖLL. — 3. IX. *r*.
Arachnactis albida M. SARS. — 31. I. *c*.
Tintinnopsis fistularis MOEB. — 26. VII. *r*.
T. ventricosa CLAP. & LACHM. — 1. IV. *r*, 7. XI. *r*.
Tintinnus Steenstrupii CLAP. & LACHM. — 10. X. *rr*.
T. subulatus EHB. — 28. X. *r*.
Acanthometron quadrifolium HKL. — 3. IX. *c*, 21. IX. *r*, 1. X. *r*.
Plectophora arachnoidea CLAP. & LACHM. — 9. II. *r*.
Ceratium tripos var. bucephala CL. — 8. VIII. *r*.
Diplopsalis lenticula BERGH. — 26. VII. *r*.
Gonyaulax spinifera CL. & LACHM. — 30. I. *r*, 3. IX. *r*.
Peridinium Michaëlis EHB. — 21. X. *r*.
Peridinium oblongum AUR. — 26. VII. *r*.
Xanthidium hystrix CL. — 28. X. *r*.
Biddulphia mobilensis BAIL. — 30. I. *r*, 28. X. *rr*, 7. XI. *rr*.
Chætoceros densus CL. — I. X. +, 10. X. *r*.
C. coronatus GRAN. — 10. X. *r*.
C. laciniosus SCHÜTT. — 14. XI. *r*, 27. XI. +.
C. similis CL. — 14. XI. *rr*, 27. XI. *r*.
C. Weissflogii SCHÜTT. — 3. IX. *c*, 21. IX. *rr*.
Coscinodiscus excentricus. — 28. X. *r*, 7. XI. *r*, 27 XI. *r*.
C. stellaris ROPER. — 1. III. *r*.
Rhizosolenia obtusa HENSEN. — 9. II. *r*., 15. II. *r*.
R. Shrubsolei CL. — 3. IX. *r*.
R. Stolterfothii H. PER. — 3. IX. *rr*.
R. styliformis BTW. — 1. X. *rr*, 7. XI. *rr*.
Stephanopyxis turgida GREV. — 21. IX. *rr*.

Table I. The North

Date	5	6	7	8	8	8	8	9	9	9	9	9	10	10	11	11	12
Lat. N.	59°32′	61°32′	63° 1′	58°51′	58°28′	57°54′	57°21′	56°49′	56°16′	55°44′	55°12′	57°47′	57°51′	58° 5′	58°21′	58°30′	58°40′
Long.	4° 15′ E.	2° 13′ E.	1° 36′ E.	5° 9′ E.	4° 27′ E.	3° 26′ E.	2° 27′ E.	1° 31′ E.	0° 33′ E.	0° 23′ E.	1° 18′ W.	10°37′ E.	7° 47′ E.	4° 45′ E.	1° 40′ E.	1° 30′ W.	4° 18′ W.
Temp.	5,1	7,4	6,7	3,8	4,4	6,4	7	6.8	7,2	6,1	6,4	2,0	2,0	3,5	6	7	7
Salinity	34,11	35,12	35,10	32,48	32,85	35,19	35,03	35,03	34,90	34,60	34,66	29,38	27,31	35,17	35,05	35,12	34,71
Acartia Clausii Giesbr.	+	*c*	*r*	.	.	.	.	.	.	.	.	.	.	*r*	.	.	.
A. longiremis Lilljeb.	.	.	.	*r*	*c*	.	*r*	.	.	.	*c*	.	.	.	.	.	.
Calanus finmarchicus Gunn.	.	.	.	.	.	*r*	+	*r*	*r*	.	*r*	.	.	.	*r*	.	.
Centropages hamatus Lilljeb.	.	.	.	*r*	*r*	.	.	.	.	.	.	.	.	*r*	.	.	.
Metridia hibernica Brady & Robts.	.	.	.	.	.	.	*r*	*r*	*r*	.	.	.	.	.	.	.	.
Microsetella atlantica Brady & Robts.	.	.	.	.	.	.	*r*	.	*r*	.	.	*r*	.	.	.	.	.
Oithona similis Claus.	*r*	*c*	+	.	.	*r*	+	*r*	*r*	*r*	+	.	.	.	+	.	.
Pseudocalanus elongatus Boeck	.	.	.	.	.	*r*	*c*	*r*	*r*	*r*	*r*	+	.	*c*	.	.	.
Temora longicornis O. F. Müll.	.	.	.	.	.	.	+	*r*	.	.	.	.	.	*c*	.	.	.
Cyttarocylis media Brandt	.	.	.	.	.	*r*	*r*	.	.	.	.	*r*	*r*	.	.	.	.
Ptychocylis acuta Brandt	.	.	.	*r*	.	*r*	.	.	.	.	.	.	*r*	.	.	.	.
Sagitta bipunctata Quoi & Gaim.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Acanthometron quadrifolium Hkl.	*r*	*r*	*r*	.	.	.	.	.	.	.	.	.	.	.	+	*r*	*r*
Halosphæra viridis Schmitz	*c*	+	+	*c*	+	*r*	+	*r*	*r*	+	*r*	*r*	*r*	*r*	*r*	.	.
Ceratium furca Duj.	.	.	.	*r*	*r*	*r*	*r*	.	*r*	.	*r*	+	.	*r*	.	.	.
C. fusus Duj.	.	.	.	*r*	.	*r*	*r*	.	.	.	*r*	.	.	*r*	*r*	.	.
C. tripos Nitzsch.	+	.	.	+	*r*	*r*	*r*	.	*r*	*r*	*r*	*r*	.	*cc*	+	*r*	.
v. longipes Bail.	.	.	.	*r*	*r*	.	*r*	.	.	*r*	*r*	+	*r*	.	+	.	.
v. macroceros Ehb.	+	+	.	+	*r*	*r*	.	.	*r*	*r*	*r*	.	.	.	.	.	.
Biddulphia aurita Lyngb.	.	.	.	+	*r*	.	.	.	.	.	.	+	*r*	.	.	.	.
B. mobilensis Bail.	.	*r*	.	.	.	.	.	.	.	*r*	.	.	.	.	.	.	+
Chætoceros atlanticus Cl.	.	.	.	.	.	*r*	.	.	.	.	.	.	.	.	*r*	.	.
C. borealis Btw.	.	.	.	*r*	*r*	.	*r*	.	*r*	*r*	*r*	.	*r*	*r*	*r*	.	.
v. Brightwellii Cl.	.	.	.	.	.	.	.	.	.	.	.	*r*	.	.	.	.	.
C. constrictus Grev.	.	.	.	*r*	.	.	.	.	.	.	.	+	*c*	.	.	.	.
C. curvisetus Cl.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.
C. debilis Cl.	.	.	.	.	*r*	.	.	.	.	.	.	*c*	*c*	.	.	.	.
C. decipiens Cl.	.	.	.	*r*	*r*	.	*r*	*r*	+	+	+	+	+	*r*	*c*	.	.
C. didymus Ehb.	.	.	.	*r*	.	.	.	.	.	.	*r*	*r*	*r*	.	.	.	.
C. Schüttii Cl.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C. teres Cl.	.	.	.	.	.	*r*	.	.	.	.	.	.	.	.	.	.	.
Coscinodiscus concinnus W. Sm.	.	*r*	.	.	.	.	.	.	*r*	+	+	.	.	.	+	.	*r*
C. excentricus Ehb.	.	.	.	.	.	+	*r*	.	.	*r*	.	.	.	.	.	.	.
C. oculus iridis Ehb.	+	.	*c*	*r*	*r*	*r*	.	.	.	.	.	.	+	.	.	.	.
Ditylum Brightwellii West.	.	.	.	*r*	.	.	.	.	.	.	.	*r*	.	.	.	.	.
Lauderia annulata Cl.	.	.	.	.	.	.	.	.	.	.	.	.	*r*	.	.	.	.
Rhizosolenia semispina Hensen	.	.	.	.	.	.	*r*	*r*	*r*	.	.	.	*r*	.	.	.	.
R. styliformis Btw.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thalassiosira Nordenskiöldii Cl.	.	.	.	*r*	*r*	.	.	.	.	.	.	*r*	+	.	.	.	.
Thalassiothrix Frauenfeldii Grun.	.	.	.	*cc*	*c*	*c*	*r*	*r*	*r*	.	*r*	*c*	*cc*	*r*	.	.	.
T. longissima Cl. & Grun.	.	.	.	*r*	.	*r*	.	.	.	.	.	*r*	.	.	.	.	.
Plankton-type	*S Tp*	*S*	*ST*	*Ns Tp Nh*	*Ns*	*Ns*	*Ns*	*Ns*	*C*	*C Nc*	*C Nc*	*Ns*	*Ns*	*Tp*	*C Tp Nc*	*O*	*Nc*

Sea in March 1898.

12	4	5	4	5	6	6	4	5	5	6	6	6	5	6	6	6	6	10	11	11	11
55°15′	57°46′	56°58′	57°18′	56°34′	56°17′	56°	57°45′	57° 4′	56°35′	56°08′	55°42′	55°13′	57°40′	57°15′	56°36′	55°43′	54°53′	53°26′	55°30′	56°10′	56°52′
5° 45′ W.	10°29′ E.	5° 44′ E.	8° 27′ E.	2° 20′ E.	0° 20′ W.	2° W.	10°22′ E.	7° 51′ E.	5° 40′ E.	3° 8′ E.	1° 5′ E.	0° 48′ W.	10°10′ E.	8° 49′ E.	8° 4′ E.	7° 29′ E.	7° 40′ E.	3° 57′ E.	6° 10′ E.	6° 56′ E.	8° 9′ E.
5,5	3	5,3	4,3	6,4	6,2	5,1	−1	+ 1	2,2	3,6	5,2	6,4	2,8	3	2,8	3,6	3,6	4,4	5,8	4,2	3,6
34,36	33,73	35,13	34,50	35,13	34,96	34,53	32,07	34,60	35,0	35,13	35,06	34,84	33,64	32,79	30,87	32,56	32,15	34,67	34,22	33,23	34,53
.	.	.	.	.	.	.	.	*r*	.	.	.	*r*	.	.	*r*	*r*	+	.	.	.	*r*
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	+	.	.	+	*r*	.	.	.	.	.	*r*	.	.	.	.	.	*r*	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	*r*	*r*	.	.	.	.	.	.
.	.	*r*	.	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	+	+	.	*c*	*c*	.	+	+	*r*	*r*	*r*	*r*	.	*r*	.	.	*r*	.	.	.
.	.	.	+	.	*c*	*r*	.	+	+	.	*r*	*r*	*r*	*r*	*r*	.	+	.	.	.	.
.	.	+	.	.	*c*	+	.	+	+	.	*r*	+	+	*c*	*c*	.	.	*r*	.	.	.
.	.	.	+	.	.	.	.	*r*	+	.	.	.	+	.	*c*	*c*	+	.	.	.	*r*
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	*r*	.	.	.	.	.	.	.
.	.	*c*	.	.	+	+	.	.	+	+	*r*	+	.	.	.	.	.	.	.	.	.
.	.	.	.	*r*	.	+	.	.	*r*	.	.	.	.	.	.	.	.	*r*	*r*	.	.
.	.	.	.	.	.	.	.	.	.	.	*r*	.	.	.	.	.	.	.	.	.	.
.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*r*	+	.	.
r	*r*	.	+	.	.	.	.	.	.	*r*	.	.	.	.	.	*r*	*r*	+	+	*r*	*r*
.	*r*	+	*c*	.	.	.	*c*	+	*c*	+	*r*	+	*r*	*r*	.	*r*	.	*c*	*c*	*c*	+
.	.	*r*	.	.	.	.	+	+	.	.	.	.	.	*r*	+	*c*	*r*	.	.	*c*	.
.	.	.	+	.	.	.	*c*	+	*r*	+	.	+	*r*	.	.	.	.	.	.	+	+
.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	*r*	.	.	*r*
r	.	+	.	.	.	+	.	.	*r*	.	.	.	.	*r*	.	*r*	.	*c*	+	*r*	+
.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*r*	.	.
.	+	*c*	.	*r*	.	.	.	.	.	*r*	.	.	.	.	*r*	.	.	.	.	.	.
.	.	*r*	.	.	.	.	.	.	.	*r*	.	.	.	.	.	.	.	.	.	.	.
.	*c*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	*r*	*r*	.	.	.	.	.	.	*r*	.	.	.	.	.	.	.	.	.	*r*	.	.
.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
rr	*c*	*cc*	.	*cc*	*cc*	+	.	.	.	*r*	*r*	*r*	*r*	*r*	.	.	.	.	*c*	.	.
.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*r*	.	.
.	.	*r*	.	.	.	.	.	.	*r*	.	.	.	.	.	.	.	.	.	+	.	.
.	*r*	*r*	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	+	+	*c*	.	+	.	*r*	.	*r*	*c*	*r*	*cc*	*r*	*cc*	*cc*	+	*c*	+	*r*	*c*
.	.	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	*r*	.	*r*	+	.	.	.	*r*	*rr*	.	*r*	.	.	.	.	.	*r*	.	*r*	.
.	*r*	.	*r*	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*c*	.	.
.	*r*	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*r*	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	*r*	*r*	+	+	.	.	.	*r*	*r*	+	.	.	*r*	.	.	.	+	+	*r*	+
.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	*cc*	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.
Nc	*Ns C*	*C* (*Nc*)	*Tp* *Nc*	*C Nc* *S*	*C S*	*C* *Nc*	*Tp*	*?*	*Tp*	*Tp*	*Nc* *S*	(*Tp*)	*Nc*	*Nc*	*Nc*	*Nc*	*Nc*	*Nc* *Tp*	*C* *Tp* *Nm*	*Tp*	*Nc* *Tp*

Tab. II. The North

Date	9—16	3	4	4	4	5	5	4	4	4	4	5
Lat. N.	61° 50′	57° 43′	57° 27′	57° 9′	56° 50′	56° 30′	56° 12′	57° 30′	56° 59′	56° 49′	56° 26′	56° 1′
Long.	2° 30′ E	9° 50′ E.	7° 32′ E.	5° 20′ E.	3° E.	0° 38′ E.	1° 51′ W.	9° 22′ E.	7° 40′ E.	6° 5′ E.	4° 1′ E.	1° 51′ E.
Temp.	10	9,8	9,0	8,7	9	8,7	9,2	9,7	9,1	9,2	8,9	9,4
Salinity	35,36	33,04	33,59	34,98	35,05	34,96	34,48	33,18	—	34,96	35,04	35,00
Acartia Clausii Giesbr.	*r*	.	.	*rr*	.	.	+	.	*r*	*r*	.	.
A. longiremis Lilljeb.	.	*r*	*r*	*r*	*cc*	.	.	*rr*	.	.	.	.
Calanus finmarchicus Gunn.	+	.	.	.	.	+	+	.	*r*	.	*r*	.
Centropages hamatus Lilljeb.	.	.	+	*r*	+	*r*	.	.	.	.	*c*	*c*
Oithona similis Claus.	*c*	.	*r*	*rr*	*c*	*r*	*c*	*rr*	.	+	.	.
Pseudocalanus elongatus Boeck.	.	.	.	.	.	.	.	.	.	.	*c*	.
Temora longicornis O. F. Müll.	.	.	.	*r*	*c*	+	.	.	.	.	*cc*	.
Evadne Nordmannii Lovén	*c*	+	+	*r*	*c*	*cc*	.	*rr*	.	.	*c*	*c*
E. spinifera P. E. Müll.	*c*	.	*ccc*	.	*c*	+	+	.	.	*r*	.	*cc*
Noctiluca miliaris Surir.	.	.	.	.	.	.	.	.	.	.	.	.
Ceratium furca Duj.	+	*r*	*r*	*r*	.	*r*	.	*r*	*r*	*r*	.	.
C. fusus Duj.	*r*	*r*	*r*	*r*	+	*r*	.	*r*	*r*	*r*	*r*	*r*
C. tripos Nitzsch.	+	+	*cc*	*ccc*	*cc*	*c*	.	*c*	*cc*	*cc*	*cc*	+
var. longipes Bail.	.	+	.	*r*	.	*c*	*r*	*c*	.	+	.	.
var. macroceros Ehb.	.	*r*	*r*	*r*	.	.	.	.	*c*	.	*c*	+
Peridinium depressum Bail.	*r*	+	.	.	.	+	.	*c*	.	*r*	.	.
P. divergens Ehb.	*r*	.	*r*	*r*	*cc*	.	*r*	.	+	.	.	.
Cerataulina Bergonii H. P.	*rr*	.	.	.	.	.	.	.	.	.	.	.
Chætoceras borealis Btw.	*rr*	.	.	.	.	.	*c*	.	.	.	.	.
C. densus Cl.	.	.	.	.	.	.	*r*	.	.	.	.	.
C. decipiens Cl.	+	.	.	.	.	.	*r*	.	.	.	.	.
C. hiemalis Cl.	.	.	.	.	.	.	*r*	.	.	.	.	.
Coscinodiscus concinnus W. Sm.	.	*r*	.	.	.	.	.	*rr*	.	.	.	*r*
Eucampia zodiacus Ehr.	.	.	.	.	.	.	.	.	.	.	.	.
Guinardia flaccida H. Per.	.	.	.	.	.	.	.	.	.	.	.	.
Lauderia annulata Cl.	.	.	.	.	.	.	+	.	.	.	.	.
Rhizosolenia semispina Hensen	*rr*	.	.	.	.	.	+	.	.	.	.	.
R. styliformis Btw.	*rr*	.	.	.	*rr*	.	*rr*	*rr*	.	.	.	.
Stephanopyxis turgida Grev.	.	.	.	.	.	.	.	.	.	.	.	.
Plankton-type	*S T C*	*Tp*	*Tp*	*Tp*	*Tp*	*Tp*	*S T*	*Tp*	*Tp*	*Tp*	*Tp*	*Tp*

Sea in June 1898.

5	5	4	5	5	5	5	4	4	5	5	5	5	5	9	9	11	12	12
55° 25′	55° 44′	57° 20′	57°	56° 26′	54° 54′	54° 14′	57° 6′	55° 46′	54° 25′	53° 51′	53° 26′	53° 8′	51° 43′	53° 49′	53° 16′	52°	50° 33′	49° 31′
0° 8′	7° 29′	9° 10′	8° 21′	7° 55′	7° 39′	8° 2′	8° 26′	7°	5° 37′	5° 1′	4° 36′	4° 22′	3° 20′	6° 18′	4° 37′	3° 23′	0° 2′	3° 29′
E.	E.	E.	E.	E.	E.	E.	E.	E.	E.	E.	E.	E.	E.	E.	E.	E.	E.	W.
10	11,2	10,08	10,5	11	10,6	12	10,36	10,24	9,48	10,48	11,24	11,48	12,48	12,4	14,1	13,4	11,8	11,8
35,15	32,36	32,20	31,57	31,86	31,57	30,19	32,48	34,21	34,41	34,45	34,33	34,40	30,93	—	—	—	—	—
c	.	.	.	.	.	+	.	*r*	+	.	.	+	.	.	.	.	.	*c*
.	.	.	.	.	.	.	.	.	.	*c*	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	*r*	.	.	.	*r*	.	.	.	.
c	.	.	.	.	.	.	.	.	.	+	.	+	+	*cc*	*r*	.	+	+
.	.	.	.	.	.	.	.	.	*c*	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	*r*	+	.	.	.	.	+	.	.	.	*c*
.	.	.	.	.	.	.	.	.	*c*	.	.	.	+	*c*	.	.	*c*	*c*
.	.	*rr*	*r*	*rr*	.	.	*r*	*r*	.	.	.	.	.	.	.	.	.	.
.	.	.	*rr*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	*c*	.	.	.	.	*ccc*	*ccc*	*ccc*	*ccc*	*cc*	.	.	.
.	*r*	.	.	*r*	*r*	*r*	.	*r*	*r*	.	.	.	.	.	.	.	.	.
r	*r*	.	.	*r*	*r*	*r*	.	*r*	+	*r*	.	*r*	.	.	*r*	.	.	.
c	.	*r*	.	+	*r*	*r*	.	*r*	*r*	.	.	.	.	.	*r*	.	.	.
ccc	.	*r*	.	*r*	*r*	*r*	.	.	.	*r*	.	.	.	.	.	.	.	.
.	.	*r*	.	+	.	.	.	.	*r*	.	.	.	.	.	.	.	.	.
.	.	.	.	+	*cc*	*r*	.	+	*cc*	+	.	.	.	.	.	.	.	.
.	.	.	*r*	.	.	.	*r*	.	.	.	.	.	.	.	.	.	.	.
.	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	*r*	.	.	.
.	+	+	*r*	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	+	.	*r*	+	*c*	.	*r*	.	.	+	+	.	.
.	*c*	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	*c*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	*r*	.	.	.	.	.	.	*rr*	.	.	.	.	.	.	.	.	.
.	.	.	.	.	*rr*	*r*	.	.	+	+	.	.	.	.	.	.	.	.
.	.	.	.	*r*	*rr*	+	*r*	*r*	*r*	.	.	.	+	.	*cc*	*cc*	.	.
.	.	+	.	.	.	*c*	.	*r*	.	*r*	.	.	.	.	.	.	.	.
.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	*r*	*r*	+	*rr*	*r*	*c*	*r*	*c*	+	*c*	.	.	.	.	.	.	.	.
.	.	.	.	.	*r*	.	.	*c*	*r*	.	.	.	.	.	.	.	.	.
Ns *Tp*	*C*	*Ns* (*Nm*)	(*S*)	(*Tp*)	*Ns?*	*Nm* (*S*)	*O*	*S* *Nm*	*Nm* (*Ns*)	*Nm* *S*	*Nm*	*Nm*	*Nm*	*Nm*	*Nm*	*Nm*	*?*	*?*

Table III. The North Sea in July, August 1898.

Month	VII	VII	VII	VII	VII	VIII	VIII	VIII	VIII	VIII	VIII	VIII	VIII	VIII	VIII	VIII	VIII	VIII	VIII
Day	29	30	30	30	30	2	2	2	3	3	3	4	6	8	6	7	7	7	7
Lat. N.	57°44′	57°32′	57°29′	57°27′	57°21′	57°42′	56°38′	55°28′	54°26′	53°18′	52°39′	51°42′	54°8′	55°30′	56°	56°15′	56°40′	57°20′	57°40′
Long.	9° 37′ E.	7° 3′ E.	6° 15′ E.	5° 23′ E.	4° 9′ E.	10° 2′ E.	7° 54′ E.	6° 46′ E.	5° 45′ E.	4° 38′ E.	3° 50′ E.	2° 34′ E.	8° 2′ E.	7° 25′ E.	7° 35′ E.	7° 50′ E.	8° 3′ E.	9° E.	10° E.
Temp.	15	12	10	11,5	12	13	13	14	14	16	16	15,5	16	14,5	13,9	14	13,5	13,5	13,8
Salinity	31,24	—	33,69	33,39	33,08	32,29	32,17	32,29	33,69	32,72	34,59	34,45	29,95	32,56	32,29	32,29	31,94	32,12	31,50
Proto pedata Leach.	.	.	.	.	.	.	.	.	.	.	+	*r*	.	.	.	.	.	.	.
Acartia Clausii Giesbr.	*r*	.	*r*	+	.	.	.	+	.	.	.	+	.	*r*	.	*r*	.	+	.
A. longiremis Lilljeb.	.	.	.	.	.	+	+	.	.	.	+	.	.	.	.	.	*r*	+	.
Calanus finmarchicus Gunn.	.	.	.	.	.	*r*	.	.	+	.	.	.	.	.	.	.	.	.	*r*
Centropages hamatus Lilljeb.	.	.	.	.	*r*	*c*	+	.	+	.	*c*	.	.	.	.	.	.	.	+
C. typicus Kröyer	.	.	.	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	*r*
Oithona similis Claus	*c*	+	+	+	+	*c*	*c*	+	*c*	.	*r*	+	+	.	.	.	*c*	*c*	*c*
Paracalanus parvus Claus	*c*	.	.	+	.	+	+	+	.	.	*c*	+	+	.	.	.	.	*c*	*c*
Pseudocalanus elongatus Boeck.	*c*	*c*	*r*	+	*c*	.	*c*	*c*	.	+	*c*	.	.	.	.	*r*	+	.	.
Temora longicornis O. F. Müll.	.	*c*	.	.	+	+	+	.	*c*	+	.	.	+	.	*r*	+	*r*	+	.
Evadne spinifera P. E. Müll.	.	+	.	.	.	+	*r*	+	+	.	.	.	.	.	.	.	.	*c*	+
Podon intermedius Lilljeb.	*r*	.	.	.	.	.	.	*r*	*c*	.	.	+	+	.	.	+	.	+	*c*
Oikopleura dioica Fol.	.	.	.	.	.	.	+	.	.	.	+	+	.	.	.	.	.	.	.
Sagitta bipunctata Quoi & Gaim.	.	.	.	.	.	*r*	.	.	.	.	.	*r*	.	.	.	.	.	.	+
Tintinnopsis campanula Ehb.	.	.	.	.	.	.	.	.	.	.	.	.	.	*r*	*r*	.	*r*	.	.
Noctiluca miliaris Surir.	.	.	.	.	.	.	.	.	.	*ccc*	*c*	*ccc*	.	.	.	.	.	.	.
Ceratium furca Duj.	.	.	.	.	.	.	.	*r*	.	.	.	.	+	+	.	.	+	.	.
C. fusus Duj.	.	*r*	*r*	*r*	*r*	.	*r*	*r*	.	.	.	.	.	+	.	*r*	.	+	*r*
C. tripos Nitzsch	+	*c*	*c*	*c*	+	*c*	*c*	*c*	.	.	.	.	*c*	*cc*	*ccc*	+	*c*	*c*	*c*
var. longipes Bail.	.	.	.	.	*r*	.	.	*r*	.	.	.	.	.	*r*	.	.	.	.	.
var. macroceros Ehb.	*c*	+	*c*	*c*	.	*c*	*cc*	*c*	+	.	.	.	*c*	+	*c*	+	*c*	*c*	+
Peridinium divergens Ehb.	.	*r*	+	*r*	.	.	.	*r*	.	.	.	.	.	*r*	+	.	*r*	*r*	*r*
Guinardia flaccida Castr.	.	.	.	.	.	.	.	*rr*	.	*r*	+	+	.	*c*	+	*r*	+	.	.
Rhizosolenia Shrubsolei Cl.	.	.	.	.	.	.	.	.	*r*	*r*	+	.	.	.	.	.	.	.	.
Plankton-type	*Tp*	*Tp*	*Tp*	*Tp*	*Tp*	*Tp*	*Tp*	*Tp*	(*Tp*)	*Nm*	*Nm*	*Nm*	*Tp*	*Tp* *Nm*	*Tp*	*Tp*	*Tp*	*Tp*	*Tp*

Table IV. The North

Date	6	6	7	7	8	8	9	12	12	12	12	13	13	13	26
Lat. N.	57°48.	57°51′	58°12′	58°15′	58°40′	58°53′	57°18′	56°47′	56°51′	56°55′	56°59′	57° 3′	57°38′	56°55′	56°14′
Long.	10°35′ E.	8° 36′ E.	5° 30′ E.	3° 50′ E.	1° 4′ W.	3° 5′ W.	5° 49′ W.	2° 46′ E.	3° 32′ E.	4° 40′ E.	5° 58′ E.	7° 16′ E.	9° 40′ E.	7° 30′ E.	7° 39′ E.
Temp.	10	10	10	10,5	11	11	11	9,4	9,7	9,7	9,1	—	9,1	—	8,4
Salinity	31,94	32,44	33,40	35,44	35,65	35,32	33,08	35,03	34,83	34,86	34,86	—	32,25	—	32,91
Proto pedata Leach.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*c*
Acartia Clausii Giesbr.	.	+	+	.	.	*c*	.	.	*r*	.	.	.	.	.	.
Calanus finmarchicus Gunn.	*c*	.	*c*	*c*	+	+	*c*	.	.	*r*	+	*c*	.	.	.
Centropages typicus Kröyer	*c*	*c*	*c*	*c*	.	*r*	.	+	*c*	*c*	+	*c*	.	*r*	.
Corycæus anglicus Lubb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Euterpe acutifrons Giesbr.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Microsetella atlantica Brady & Robts.	.	.	.	.	.	.	.	.	.	.	.	*r*	.	.	.
Oithona similis Claus	+	.	+	.	.	.	*r*	.	.	.	.	.	.	*r*	.
Paracalanus parvus Claus	*c*	+	.	+	.	+	.	.	+	*c*	+	*c*	.	.	*c*
Pseudocalanus elongatus Boeck.	*c*	.	*c*	+	.	+	.	*c*	.	.	.	.	.	.	.
Temora longicornis O. F. Müll.	*c*	.	+	+	.	.	.	*c*	*c*	*c*	+	*c*	*r*	*r*	.
Limacina balea Möller	.	.	.	.	.	.	.	*r*	.	*c*	*c*	*c*	*r*	.	.
Sagitta bipunctata Quoi & Gaim.	*c*	*cc*	*c*	*c*	.	.	.	*c*	.	+	.	.	.	.	+
Tintinnopsis campanula Ehb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Acanthometron quadrifolium Hkl.	.	*rr*	*rr*	.	*rr*	*r*	.	.	.	.	.	.	.	.	.
Plectophora arachnoides Clap. & Lachm.	*rr*	*rr*	*rr*	.	.	*rr*	.	.	.	.	.	.	.	*r*	.
Halosphæra viridis Schmitz.	+	*c*	.	+	+	*c*	*c*	*r*	+	.	*r*	+	.	.	.
Ceratium furca Duj.	*r*	.	*r*	.	.	*r*	.	+	.	.	.	+	*c*	*rr*	.
C. fusus Duj.	+	*c*	*r*	*c*	.	*r*	.	+	+	+	*r*	+	*r*	*rr*	.
C. tripos Nitzsch	*c*	*ccc*	*cc*	*cc*	+	*ccc*	*r*	*cc*	*c*	+	*cc*	*c*	*c*	*cc*	+
var. bucephala Cl.	*r*	*c*	+	+	+	.	*r*	+	*r*	*r*	+	+	.	.	.
var. macroceros Ehb.	*cc*	*cc*	*ccc*	*ccc*	*cc*	*cc*	*r*	*cc*	*c*	+	*cc*	.	*c*	*rr*	.
Dinophysis acuta Ehb.	.	.	.	.	.	.	.	*r*	*r*	.	*r*	.	*r*	.	.
Peridinium depressum Bail.	*r*	.	*r*	*r*	*r*	+	.	.	.	.	*r*	.	*r*	.	.
P. divergens Ehb.	.	.	.	.	.	.	.	.	.	.	.	*r*	.	.	.
Pyrophacus horologium Stein	.	.	.	.	.	*rr*	.	.	.	.	.	.	.	.	.
Bellerochea malleus Btw.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Biddulphia mobilensis Bail.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Chatoceros curvisetus Cl.	.	.	.	.	.	.	.	.	.	.	.	*r*	.	.	.
C. decipiens Cl.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Coscinodiscus concinnus W. Sm.	.	.	*rr*	*r*	.	.	.	.	.	.	.	.	.	+	+
C. excentricus Ehb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ditylum Brightwellii West.	.	.	.	.	.	.	.	.	.	.	.	.	.	*rr*	.
Guinardia flaccida H. Per.	.	.	.	.	.	.	.	.	.	.	.	.	.	*r*	.
Rhizosolenia calcar avis Schulze	.	.	.	.	.	.	.	.	.	.	.	.	.	*rr*	.
R. styliformis Btw.	.	.	*rr*	.	.	*rr*	.	.	.	.	.	*rr*	.	*rr*	.
Streptotheca thamesis Shrubs.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Plankton-type	*Tp* (*Nh*)	*Tp* *Nh*	*Tp*	*Tp* (*Nh*)	*Tp* (*Nh*)	*Tp* *Nh*	*Nh*	*Tp*	*Tp*	(*Tp*)	*Tp*	*Tp* (*Nh*)	*Tp*	*Tp*	*Nm* *Nc*

Sea in November 1898.

26	5	5	6	6	6	7	7	13	13	14	14	14	14	15	15	15	15	13	14
55°30′	57°41′	57°22°	57°1′	56°42′	56°11′	55°35′	55° 1′	50°15′	50°58′	51°45′	52°32′	53°19′	54°15′	54°51′	55°50′	56°28′	57°2′	51°	51°
7° 20′ E.	9° 55′ E.	8° 21′ E.	6° 17′ E.	4° 22′ E.	2° 31′ E.	0° 34′ E.	1° 10′ W.	0° 30′ E.	1° 10′ E.	2° 14′ E.	3° 11′ E.	4° E.	4° 47′ E.	5° 36′ E.	6° 47′ E.	7° 46′ E.	8° E.	1° W.	2° 5′ W.
9,2	9,5	11,2	10,7	10,1	10,0	9,8	9,4	14	13,2	14	13	12,2	12	12	11,2	10	9	14,5	14
34,12	32,56	33,93	34,86	34,94	35,10	35,29	34,21	35,37	35,46	35,37	35,56	35,08	35,17	35,01	35,01	32,79	31,74	34,55	35,60
rr	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	+	.	.
.	+	.	.	.	+	+	.	*c*	.	*c*	*r*	.	.	.	.	.	.	*r*	*r*
rr	.	.	.	.	+	.	.	.	.	*rr*	.	*r*	.	.	.	.	.	.	.
.	.	.	.	+	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	*r*
.	*r*	*r*	.	.	.	.	.	*r*	.	*r*	.	+	.	*r*	*r*	+	.	.	.
.	.	.	.	.	.	.	.	+	*r*	+	.	.	.	.	.	.	.	*r*	.
+	*r*	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	*r*	.	.
r	.	+	.	+	+	+	.	.	.	*r*	.	.	.	*r*	.	*r*	*r*	*r*	.
.	+	*c*	.	+	*c*	.	.	+	+	*c*	.	+	.	*r*	+	.	.	*r*	*r*
rr	.	+	.	*c*	*r*	*r*	.	.	.	.	*r*	+	.	*c*	.	*r*	*r*	.	.
.	.	.	.	.	*r*	*r*	.	*r*	+	+	+	*r*	.	.	.	+	*c*	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	+	*c*	*ccc*	*ccc*	*c*	*r*	.	+	.	+	+	.	+	+	*c*	+	*c*	.	.
.	.	.	.	.	.	.	.	.	.	*r*	*r*	+	*r*	.	+	.	.	*r*	.
.	.	.	.	*r*	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*rr*	.	.	.
.	.	.	.	*r*	*r*	+	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	+	.	.	.	.	.	.	.	*r*	*r*	.	.	.	.	.
.	.	*r*	.	*c*	+	.	+	.	.	.	.	.	*r*	*r*	.	*r*	*r*	.	.
.	+	+	*c*	*c*	*c*	*cc*	+	.	.	.	.	+	*c*	*c*	+	*c*	*c*	.	.
.	.	.	.	+	+	.	.	.	.	.	.	*r*	.	*r*	.	.	.	.	.
.	+	+	*c*	*c*	*c*	*cc*	+	.	.	.	.	*c*	+	+	.	*cc*	*c*	.	.
.	.	.	.	.	*r*	*r*	*r*	.	.	.	.	.	.	.	.	.	.	.	.
r	.	.	.	.	*r*	.	.	.	.	.	*r*	.	.	.	.	*r*	*r*	.	.
.	.	.	.	.	*r*	.	.	.	.	.	.	.	*r*	.	.	*r*	.	.	.
.	.	.	.	*r*	*r*	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	+	.	*r*	*r*	+	.	.	.	.	.	*r*	.
r	.	.	*r*	.	.	.	.	*c*	+	*c*	*c*	*c*	*c*	*r*	*r*	.	.	*r*	.
r	.	.	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	*r*	.	.	.	.	.	.	*r*	.	.	*r*	.	.	.	.	*rr*
.	+	+	*r*	*c*	.	.	.	*c*	.	+	+	+	*r*	+	*r*	*r*	*r*	.	.
.	.	.	.	.	.	.	.	.	.	.	*r*	.	+	*r*	*c*	*r*	.	.	*r*
.	.	.	.	.	.	.	.	.	.	*c*	.	*r*	*c*	+	.	*r*	.	*r*	.
.	.	.	.	.	.	.	.	.	.	*r*	.	.	+	+	+	+	+	*r*	.
r	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	+	*r*	.	.
+	*ccc*	*c*	*c*	+	.	*r*	.	.	.	.	.	.	.	.	.	*r*	*r*	.	.
.	.	.	.	.	.	.	.	*r*	.	*r*	.	.	.	*r*	.	.	.	*c*	.
S	*S* (*Tp*)	*S* (*Tp*)	*S* *Tp*	*Tp* (*S*)	*Tp*	*Tp*	(*Tp*)	*Nm* *Nc*	*Nm*	*Nm* *Nc*	*Nc* *Nm*	*Nc* *Nm* *Tp*	*Nc* *Tp*	*Nc* *Tp* *Nm*	*Nc* *Tp* *Nm*	*Tp* (*Nm*)	*Tp* *Nm*	*Nm*	*O*

Table V.

Month	1	2	4	5	5	5	5	6	6	6	6	7
Day	4	9	26	3	12	17	27	3	8	14	23	22
Temp.	5,7	4,4	8,7	10,3	9,9	10,6	11,9	12,4	14,6	15,0	14,6	—
Areom. Density	1,0242	1,0210	1,0235	1,0240	1,0244	1,0234	1,0247	1,0205	1,0225	1,0217	1,0247	—
Wind	SW.	NE.	NE.	SE.	NNW.	E.	NW.	W.	ENE.	NE.	W.	—
Tide	Ebb.	Ebb.	Ebb.	Flood.	Ebb.	Flood.	Ebb.	Flood.	Ebb.	Flood.	Ebb.	—
Oikopleura dioica Fol.	.	.	.	.	.	.	.	.	.	.	.	.
Centropages hamatus Lilljeb.	.	.	*r*	.	.	.	.	.	.	.	.	.
C. typicus Kröyer	.	.	.	.	.	.	.	.	.	.	.	.
Corycæus anglicus Lubbock	.	.	.	.	.	.	.	.	.	.	.	.
Euterpe acutifrons Dana	.	.	.	.	.	.	.	.	.	.	.	.
Oithona similis Claus	.	.	.	.	.	.	.	.	.	.	.	.
Paracalanus parvus Claus	.	.	.	.	.	.	.	.	.	.	.	.
Temora longicornis O. F. Müll.	.	.	*r*	.	*r*	.	.	.	.	.	.	.
Podon polyphemoides Leuck.	.	.	.	.	.	.	.	.	.	.	.	.
Noctiluca miliaris Suriray	.	.	.	.	.	*c*	.	.	+	*c*	*c*	.
Ptychocylis Ehrenbergii Clap. & Lachm.	.	.	.	.	.	.	.	.	.	.	.	.
Tintinnopsis beroidea v. acuminata Dad.	.	.	.	.	.	.	.	.	*r*	.	.	.
T. campanula Ehb.	.	.	.	.	.	.	.	.	.	.	.	*r*
T. ventricosa Clap. & Lachm.	.	.	.	.	.	.	.	.	.	.	.	.
Phæocystis Pouchetii Lagh.	.	.	*ccc*	*c*	.	.	.	.	.	.	.	*r*
Ceratium fusus Duj.	.	.	.	*r*	.	+	*r*	*r*	*r*	*r*	*r*	.
C. trip. v. longipes Bail.	.	.	.	.	.	.	.	.	.	.	.	.
Peridinium ovatum Pouchet.	.	.	.	.	.	.	.	.	.	.	.	.
Bacteriastrum varians Lauder	.	.	.	.	.	.	.	.	.	.	.	.
Biddulphia aurita Lyngb.	.	*rr*	.	.	.	.	.	.	.	.	.	.
B. mobilensis Bail.	.	.	.	.	.	.	.	.	.	.	.	.
Cerataulina Bergonii H. Per.	.	.	*r*	+	*c*	.	+	+	.	.	.	.
Chætoceros debilis Cl.	.	.	.	.	.	.	.	.	.	.	.	.
C. decipiens Cl.	.	.	.	+	*r*	*r*	.	.	.	.	.	.
C. (borealis v.?) densus Cl.	.	.	.	.	.	.	.	.	.	*r*	.	.
C. didymus Ehb.	.	.	.	.	.	.	.	.	.	.	.	.
C. Schüttii Cl.	.	.	.	.	.	.	.	.	.	.	.	.
Coscinodiscus concinnus W. Sm.	*r*	*r*	.	.	.	.	.	.	.	.	.	.
C. excentricus Ehb.	*r*	.	.	.	.	.	.	.	.	.	.	.
C. oculus iridis Ehb.	.	.	.	.	.	.	.	.	.	.	.	.
Ditylum Brightwellii West.	.	.	.	.	.	.	.	.	.	.	.	.
Eucampia zodiacus Ehb.	.	.	.	+	*cc*	*c*	*c*	+	+	+	.	.
Guinardia flaccida Castr.	.	.	.	+	*c*	*c*	+	*cc*	*cc*	*cc*	*cc*	*c*
Lauderia annulata Cl.	.	.	.	.	.	.	.	.	.	.	.	.
Lithodesmium undulatum Ehb.	.	.	.	.	.	.	.	.	.	.	.	.
Rhizosolenia calcar avis Schulze	.	.	.	.	.	.	.	.	.	.	.	.
R. delicatula Cl.	.	.	.	.	.	.	.	.	.	.	.	.
R. setigera Btw.	.	.	.	.	.	.	.	.	*rr*	.	.	.
R. Shrubsolei Cl.	.	.	.	.	.	+	+	.	+	+	*r*	*c*
R. Stolterfothii H. Per.	.	.	.	*rr*	*r*	*c*	.	+	.	.	.	.
Thalassiosira gelatinosa Hensen	.	.	.	.	.	.	.	.	.	.	.	.

Helder 1898.

7	8	8	8	9	9	9	9	10	10	11	11	11	11	12	12	12	12	12
25	1	11	24	8	16	23	29	8	28	4	11	18	24	3	10	17	21	28
16,4	17,2	17,7	19,3	19,2	19,0	16,2	15,2	12,8	12,3	11,8	10,2	9,0	5,4	8,6	8,4	7,4	6,2	6,6
1,0325	1,0224	1,0234	1,0228	1,0232	1,0221	1,0237	1,0248	1,0235	1,0245	1,0240	1,0247	1,0238	1,0233	1,0256	1,0253	1,0247	1,0251	1,0250
NW.	NW.	WSW.	NNW.	—	ESE.	N.	WSW.	ENE.	SSW.	WSW.	E.	ESE.	ESE.	—	—	W.	—	SW.
Ebb.	Flood	Ebb.	Ebb.	Ebb.	Ebb.	Ebb.	Flood.	Ebb.	Ebb.	Ebb.	Flood.	Ebb.	Flood.	Ebb.	Flood.	Ebb.	Ebb.	Flood.
.	.	*r*	.	*r*	.	.	*r*	.	.	.	.	.	.	.	.	.	.	.
.	.	*r*	*r*	+	.	.	.	*r*	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*r*	+	.
.	.	.	.	.	.	.	.	.	.	.	*r*	.	.	*r*	*r*	.	*r*	.
.	.	.	.	.	.	*r*	+	*c*	*r*	.	*c*	+	*r*	*r*	.	.	+	.
.	.	*r*	*r*	.	*r*	*r*	+	+	*r*	*r*	+	*r*	.	.	.	.	*c*	*r*
.	.	*r*	.	*r*	.	.	*r*	.	.	*r*	.	.	.	*r*	*r*	.	.	*r*
.	.	*r*	.	.	*r*	.	*r*	*r*	.	.	.	.	.	.	+	*r*	+	*r*
.	.	*rr*	.	.	.	.	*r*	.	.	.	.	.	.	.	.	.	.	.
c	+	*ccc*	*c*	*cc*	+	.	.	*r*	*r*	*r*	*r*	.	.	.	.	.	.	.
.	.	.	.	.	.	.	*r*	*r*	.	.	.	.	*rr*	.	.	*rr*	.	.
.	.	.	.	.	.	+	+	*r*	.	.	*r*	.	.	.	.	+	*c*	*r*
r	*r*	*r*	*r*	+	.	+	+	*r*	*r*	.	.	*r*	.	.	.	.	.	.
.	*r*	*r*	*rr*	*r*	+	.	*r*	.	.	.	*r*	.	.	.	.	.	.	.
r	+	.	*c*	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	*r*	.	.	*r*	*r*	.	.	*c*	*r*
.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	*c*	*r*
.	.	.	.	.	.	.	*r*	*r*	.	*r*	.	*rr*	.	.	.	.	.	.
.	.	*c*	+	.	+	+	*c*	*r*	*r*	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*rr*	*c*	.
.	.	.	.	.	.	+	*c*	+	+	+	*c*	+	.	+	+	+	+	*r*
.	.	.	.	.	.	.	.	.	.	.	*r*	.	.	.	.	.	.	.
.	.	.	.	.	.	.	+	*r*	*cc*	.	*cc*	*c*	*cc*	.	.	*r*	*c*	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	*r*	*r*	.	*r*	.	*r*	*r*	+	*r*	+	*r*	*r*	*r*	.	.	.	.
.	*rr*	.	*rr*	.	.	.	*r*	*r*	*r*	.	*r*	*r*	*r*	.	.	.	.	.
.	.	.	.	.	.	.	*rr*	.	.	*r*	*r*	*r*	*r*	.	.	.	.	.
.	.	.	.	.	.	+	*c*	+	*r*	+	*r*	.	.	*cc*	+	+	+	*r*
.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	+	.
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.	.	.	.	.	.	.	.	.	+	+	*r*	*r*	*r*	*r*	.	*r*	*r*	.
.	.	.	.	.	.	.	*cc*	.	*r*	*r*	.	+	*r*	.	.	.	.	.
cc	*c*	+	.	*c*	*c*	.	*c*	.	*r*	.	*r*	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	*r*	.	.	*r*	.	.	.	.	*rr*	.
.	.	.	.	.	.	.	+	*r*	*r*	.	*r*	+	*r*	.	.	*r*	*r*	*r*
.	.	.	.	.	.	.	*r*	.	.	.	*r*	.	*r*	.	.	.	.	.
.	.	*rr*	.	.	*rr*	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	*r*	.	.	*rr*	.	*r*	.	*r*	*r*	*r*	.	.	.	*r*	.
+	*c*	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	*r*	+	*r*	.	.	.	*r*	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*r*	.

Table VI.

Month	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	6
Day	12	18	27	4	11	16	23	3	8	15	23	31	5	14	21	28	11	20	26	7
Acartia Clausii Giesbr.	*r*	*r*	.	.	.	*r*	*r*	*r*	*r*	.	+	+	.	.	*r*	.	*cc*	.	+	.
Calanus finmarchicus Gunn.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*r*	*r*
Centropages typicus Kröyer	*r*	*r*	.	.	.	.	.	.	.	*r*	.	.	.	.	*r*	.	+	+	+	.
Corycæus anglicus Lubb.	*r*	+	*r*	.	*r*	*r*	*r*	.	*r*	.	.	*r*	.	.	.	.	.	.	.	.
Euterpe acutifrons Dana.	*r*	*r*	.	*r*	*r*	.	*r*	.	+	.	.	+	.	.	.	.	.	.	.	.
Oithona similis Claus	*r*	+	.	*r*	*r*	+	*r*	*r*	+	*c*	+	+	*r*	*r*	.	*rr*	.	+	.	.
Paracalanus parvus Claus	*r*	*c*	.	.	*r*	.	.	.	.	+	*r*	.	.	.	.	.	.	+	.	.
Pseudocalanus elongatus Boeck.	.	+	.	.	.	*r*	*r*	.	*r*	+	*r*	.	.	.	.	.	.	.	.	.
Temora longicornis O. F. Müll.	.	.	.	.	.	.	*r*	.	.	.	.	*c*	.	.	*r*	.	*c*	.	.	.
Sagitta bipunctata Quoi & Gaim.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Noctiluca miliaris Suriray	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Acanthochiasma fusiforme Hkl.	*r*	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ptychocylis Ehrenbergii Clap. & Lachm.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tintinnopsis beroidea v. acuminata Dad.	.	.	.	.	.	*r*	.	.	.	.	.	*r*	.	.	.	?	.	.	.	.
T. campanula Ehb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Phæocystis Pouchetii Lagh.	.	.	.	.	.	.	.	.	.	.	*r*	.	+	*c*	*c*	*cc*	*ccc*	*ccc*	*cc*	*cc*
Ceratium fusus Duj.	.	.	*r*	.	.	.	.	*r*	.	+	.	*r*	+	.	+	*c*	.	.	.	.
C. tripos Nitzsch	.	+	+	*r*	.	.	*r*	*r*	*r*	+	.	.	.	.	.	*r*	.	.	.	.
v. longipes Bail.	.	.	.	.	.	.	.	*rr*	.	*r*	.	.	.	.	*r*	*rr*	.	.	.	.
Diplopsalis lenticula Bergh.	.	*r*	.	.	.	.	.	*r*	.	*r*	.	.	.	.	.	*r*	.	.	.	.
Peridinium divergens Ehb.	.	*r*	*r*	.	.	.	.	.	.	+	.	+	*r*	.	.	*r*	.	.	.	.
Halosphæra viridis Schmitz	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asterionella japonica Cl.	.	.	.	.	.	.	.	.	.	.	*rr*	.	*r*	*r*	.	*rr*	.	.	.	.
Biddulphia mobilensis Bail.	*c*	*c*	*c*	*c*	*c*	*c*	*c*	+	+	+	+	.	.	.	.	.	.	.	.	.
Cerataulina Bergonii H. P.	.	.	.	.	.	.	.	*rr*	.	.	.	.	*r*	.	+	+	.	.	.	.
Chætoceros curvisetus Cl.	.	.	.	.	.	.	.	.	*r*	.	*c*	.	+	.	.	.	.	.	.	.
C. decipiens Cl.	*r*	*r*	*r*	.	.	*r*	.	.	.	+	+	*r*	+	.	.	.	.	.	.	.
C. (borealis var.) densus Cl.	.	.	.	.	.	.	.	.	.	.	+	*r*	*c*	*c*	+	*r*	.	.	.	.
C. didymus Ehb.	.	.	.	.	.	.	.	.	.	*rr*	.	.	.	.	.	.	.	.	.	.
C. Lorenzianus Grun.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C. Schüttii Cl.	.	.	.	.	.	*rr*	.	.	.	*rr*	.	.	.	.	.	.	.	.	.	.
Coscinodiscus concinnus W. Sm.	*c*	*c*	*c*	*c*	*c*	*c*	*c*	*r*	*r*	+	+	*c*	+	*c*	+	.	.	+	.	+
C. excentricus Ehb.	.	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ditylum Brightwellii West.	.	*r*	*r*	.	.	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.
Eucampia zodiacus Ehb.	.	.	.	.	.	.	.	.	.	.	*r*	.	*c*	+	*c*	*c*	.	.	.	.
Guinardia flaccida Castr.	.	.	.	.	.	.	.	.	.	.	*r*	*r*	.	.	.	.	.	.	.	.
Lauderia annulata Cl.	*r*	.	.	.	.	.	.	*r*	*r*	*c*	*c*	.	.	.	+	.	.	.	.	.
Rhizosolenia alata Btw.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
v. corpulenta Cl.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*rr*	.	.	.	.	.
R. gracillima Cl.	.	.	.	.	.	.	.	.	.	.	.	*r*	*r*	*r*	.	*r*	.	.	+	*r*
R. robusta Norm.	.	.	.	.	.	.	.	.	.	.	.	.	*r*	*r*	*r*	.	*r*	.	.	.
R. semispina Hensen	.	.	.	.	.	.	.	.	.	.	.	.	.	*r*	.	+	.	.	+	*r*
R. Shrubsolei Cl.	.	.	*r*	.	.	.	.	.	.	*r*	.	.	.	.	+	*c*	.	.	.	.
R. Stolterfothii H. P.	.	.	.	.	.	.	.	.	.	.	*r*	.	*c*	*c*	*c*	*cc*	.	+	*cc*	*c*
R. styliformis Btw.	.	.	.	.	.	.	.	.	.	.	*r*	*r*	*r*	.	*r*	.	.	.	*r*	*r*
Skeletonema costatum Grev.	.	.	.	.	.	.	.	.	.	.	*c*	.	.	.	.	.	.	.	.	.
Stephanopyxis turgida Grev.	.	.	.	.	.	.	.	.	.	.	.	.	*r*	*r*	*r*	*r*	.	.	.	.
Streptotheca thamesis Shrub.	*r*	+	.	.	*r*	+	*r*	*r*	.	.	*r*	.	.	.	.	.	.	.	.	.
Plankton-type	*Nc*	*Nc*	*Nc*	*Nc*	*Nc*	*Nc*	*Nc*	(*Nc*)	(*Nc*)	(*Nc*)	(*Nc*) *S* *Ns*	*Nc* (*S*)	*Nm*	*Nm* *C*	*Nm* *C*	*Nm* *C*	*C* *S*	*C*	*Nm* *C*	*Nm* *C*

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6 15	6 23	7 5	7 14	7 22	7 30	8 5	8 12	8 16	8 24	9 2	9 9	9 22	9 27	10 4	10 11	10 20	10 31	11 3	11 9	11 12	11 17	11 22	12 1	12 3	12 7	12 14	12 19	12 31
r	*r*	.	+	.	*c*	.	*c*	*r*	.	.	*c*	*r*	+	.	*r*	*r*	.	.	.	*r*	.	*r*	.	+	*r*	.	.	.
.	.	+	*r*	.	.	.	*r*	.	.	.	.	*r*	+	*r*	*r*	*r*	.	.	*r*	+	+	.	.	.	.	.	.	.
r	.	*r*	.	.	.	.	+	.	*r*	.	+	*r*	+	+	+	*r*	.	.	.	.	+	.	.	.	.	.	.	.
r	*r*	.	*r*	.	.	.	.	.	.	*r*	.	*r*	*c*	+	+	+	+	.	+	*r*	+	+	*r*	+	.	*c*	+	.
r	.	.	.	.	.	.	.	.	.	*r*	.	.	*r*	+	*c*	*cc*	*c*	+	*c*	*r*	.	.	.	*r*	.	.	.	.
.	*r*	.	.	.	+	.	.	+	*c*	*r*	.	+	.	+	.	.	.	*r*	*c*	+	.	*r*	.	+	.	*c*	.	.
.	.	.	.	.	*c*	.	.	+	+	.	*c*	*c*	*c*	*c*	*c*	*cc*	+	*r*	*r*	*c*	+	*r*	.	.	.	.	*c*	.
.	+	.	.	.	.	.	.	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	+	.	.	.	*r*	.	.	.	+	.	.	.	.	.	*r*	.	*r*	.	+	.	*r*	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	+	*r*	.	.	*r*	+	*r*	.	.	*c*	+	.	.	.	.	.	.	.	.
.	*ccc*	.	.	*ccc*	*c*	.	.	.	.	*r*	+	*r*	*r*	*cc*	*ccc*	*cc*	*c*	+	+	*r*	*c*	.	*c*	.	.	.	*rr*	.
.	.	.	.	.	.	.	*c*	*r*	.	.	.	.	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	*c*	.	*r*	.	+	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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+	.	.	.	.	*c*	*c*	.	*r*	.	.	+	*r*	.	.	.	*r*	+	.	*r*	*r*	+	*c*	*r*	*r*	*r*	+	*c*	.
.	+	.	.	+	*c*	*c*	.	.	.	*rr*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
+	.	.	.	.	.	.	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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+	.	.	.	.	.	.	.	.	.	*rr*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	*r*	*c*	*c*	*r*	*cc*	*c*	*c*	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	*c*	+	*r*	.	.	.	.	.	*r*	*c*	+	+	.	*r*	.	*r*	.
r	.	.	.	.	.	*c*	+	.	.	.	*r*	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	*rr*	.	.	.	.	.	.	*c*	*r*	*r*	*r*	.	*r*	.	.
.	.	.	.	.	.	+	+	+	.	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	*c*	*r*	*c*	*c*	*c*	*c*	.	*r*	.	.	.	.	.	.	.	.	.	.	*c*	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	*c*	*cc*	.	+	*c*	+	*cc*	*cc*	*c*	*c*	*c*	*r*	*r*	*c*	*cc*	.
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.	.	.	.	.	*r*	+	+	*r*	.	+	.	+	.	.	.	.	.	.	.	.	+	*r*	+	.	.	.	*r*	.
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.	.	.	.	.	.	*r*	.	*r*	.	*r*	.	.	*r*	*r*	*r*	.	*r*	.	.	.	+	*r*	*r*	.	.	.	.	.
+	.	*cc*	*ccc*	*cc*	*ccc*	*c*	*cc*	*cc*	.	*c*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	*rr*	.	*r*	*r*	*c*	*r*	*r*	+	+	*r*	*r*	*cc*	*r*	*r*	*r*	.	*r*	*r*	.
.	.	.	.	.	.	.	.	.	.	.	*rr*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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c	+	.	.	.	.	+	*r*	*r*	.	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
+	*rr*	.	.	.	*r*	*r*	.	.	.	*r*	*r*	*r*	.	.	*r*	.	+	.	.	.	*r*	*r*	.	.	.	.	.	.
.	.	.	.	.	*c*	*c*	.	+	*r*	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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Nm S	*Nm*	*Nm*	*Nm*	*Nm*	*Nm Ns*	*Nm Ns*	*Nm*	*Nm*	*Nm*	*Nm*	*Nm*	*Nm C*	*Nm Nc*	*Nm Nc S*	*Nm*	*Nm*	*Nm Nc S*	*Nm Nc S*	*Nc*	*Nc*	*Nc Nm S C*	*Nc Tp C*	*Nc Nm*	(*Nm*)	(?)	*Nm Nc*	*Nc Nm Tp*	*O*

Table VII.

Month	I	I	I	II	II	II	III	III	III	III	III	IV	IV	IV
Date	2	10	30	9	15	22	1	8	11	21	29	1	7	13
Temp.	3,70	3,65	—	—	2,10	2,45	1,95	1,80	—	—	2,10	—	3,95	3,40
Sal.	23,58	25,95	—	—	26,27	27,34	22,62	26,94	—	—	22,48	—	27,22	24,04
Oikopleura dioica Fol.	.	.	*r*	.	.	.	.	.	.	.	.	.	.	.
Acartia Clausii Giesbr.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
A. longiremis Lilljeb.	+	.	.	*r*	*r*	.	*r*	*r*	*r*	.	.	*rr*	*r*	.
Calanus finmarchicus Gunn.	.	.	*r*	*r*	.	.	.	.	.	.	.	.	.	.
Centropages hamatus Lilljeb.	+	.	+	.	.	.	.	.	*r*	.	.	*rr*	.	.
C. typicus Kröyer	*r*	.	*r*	.	.	.	.	.	.	.	.	.	.	.
Oithona similis Claus	*c*	+	.	.	*r*	.	*r*	*r*	.	.	.	*rr*	.	.
Paracalanus parvus Claus	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pseudocalanus elongatus Boeck.	.	.	.	+	*r*	.	*r*	*r*	*r*	.	.	*r*	.	.
Temora longicornis O. F. Müll.	+	.	.	+	.	.	*rr*	.	*r*	.	.	.	.	.
Evadne Nordmannii Lovén	.	.	.	.	.	.	.	.	.	.	.	.	.	.
E. spinifera P. E. Müll.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Podon intermedius Lilljeb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sagitta bipunctata Quoi & Gaim.	+	.	.	*r*	.	.	.	.	.	.	.	.	.	.
Cyttarocylis denticulata Ehb.	*r*	.	*r*	.	*r*	.	*r*	.	.	.	.	.	*r*	.
Ptychocylis acuta Brandt	*r*	.	*r*	*r*	*r*	*r*	*r*	.	.	.	.	.	.	.
Tintinnopsis beroidea v. acuminata v. Dad.	.	.	*r*	.	.	.	.	.	.	.	.	.	.	*rr*
T. campanula Ehb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Distephanus speculum Ehb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Halosphæra viridis Schmitz	*r*	+	*cc*	*c*	+	*r*	.	.	.	*rr*	.	.	.	.
Ceratium furca Duj.	.	.	+	*r*	.	.	.	.	.	*rr*	.	.	*r*	.
C. fusus Duj.	.	.	.	.	.	.	.	.	.	*rr*	.	.	*r*	.
C. lineatum Ehb.	*r*	.	.	.	.	.	.	.	.	*rr*	.	.	.	.
C. tripos Nitzsch	*ccc*	+	*cc*	*c*	+	+	*r*	*r*	.	*rr*	*rr*	.	*r*	.
v. longipes Bail.	*r*	*r*	*r*	+	+	+	*r*	+	.	*rr*	.	*r*	*r*	*rr*
v. macroceros Ehb.	.	.	*r*	.	.	+	.	.	.	.	.	.	.	.
Dinophysis acuta Ehb.	*r*	.	*r*	.	.	.	*r*	.	.	.	.	.	.	.
Peridinium depressum Bail.	*r*	.	.	.	*r*	+	*r*	*r*	.	*r*	.	*r*	.	.
P. divergens Ehb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Xanthidium multispinosum Moeb.	.	.	.	.	.	.	.	.	.	.	.	*r*	.	.
Biddulphia aurita Lyngb.	*rr*	.	*r*	*r*	*r*	*c*	*r*	*r*	.	*r*	.	*r*	.	.
Cerataulina Bergonii H. Per.	*rr*	.	.	.	.	.	.	.	.	.	.	.	*r*	*r*
Chætoceros borealis Btw.	.	+	*r*	*r*	*r*	+	.	*r*	.	.	*r*	*r*	+	.
v. Brightwellii Cl.	*rr*	.	.	*r*	.	.	.	*r*	.	.	.	.	.	.
C. constrictus Gran.	*rr*	.	*r*	*r*	+	*c*	*c*	*c*	*c*	*cc*	*cc*	*cc*	*cc*	*ccc*
C. contortus Schütt.	.	.	.	+	+	+	+	+	+	*c*	+	+	.	+
C. curvisetus Cl.	*rr*	*r*	*r*	+	*r*	+	+	*r*	*r*	*r*	*r*	+	*r*	*r*
C. danicus Cl.	.	.	.	.	.	.	.	.	.	.	.	*r*	+	+

Måseskär 1898.

IV	IV	V	V	V	V	VI	VI	VII	VII	VIII	VIII	VIII	IX	IX	X	X	X	X	XI	XI	XI
20	25	1	10	16	27	4	10	6	26	8	15	24	3	21	1	10	21	28	7	14	27
3,25	—	5,95	8,30	8,45	10,10	11,45	16,5	15,55	14,80	14,65	15,30	17,10	14,70	14,10	—	—	8,10	8,65	8,35	7,10	4,85
25,28	—	19,78	18,61	22,22	20,29	20,43	19,56	18,83	24,32	24,58	23,59	19,66	30,10	27,01	—	—	22,60	22,56	25,83	18,78	23,05
.	.	.	.	.	.	.	.	c	+	+	+	+	c	+	c	.	+	+	+	+	.
.	rr	.	.	.	+	.	.	.	r	+	c	c	+	.	r	.	r	.	.	r	rr
.	r	r	r	.	+	r	.	.	.	.	.	.	r	.	.	.	.	r	r	+	.
.	.	.	.	.	.	.	.	.	r	.	+	r	.	+	+	+	.	.	.	.	.
.	rr	r	r	.	+	r	r	r	.	r	.	.	r	.	r	.	.	r	.	c	.
.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	c	c	c	+	.	.	.
.	.	r	r	rr	.	r	+	c	+	c	c	c	c	c	c	+	+	c	+	.	.
.	.	.	.	.	.	.	.	c	+	c	cc	c	cc	c	c	c	c	+	.	.	rr
.	.	r	.	.	+	.	.	.	.	+	.	r	+	.	+	.	r	.	.	.	rr
.	.	.	.	.	+	r	+	.	.	r	r	.	r	.	.	.	r	r	.	r	rr
.	.	rr	r	rr	+	r	+	.	r	c	.	.	.	+	+	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	c	cc	.	c	.	c	c	r	.	.	.	rr
.	.	.	.	.	.	.	.	.	rr	rr	rr	.	r	rr	r	.	r	r	.	.	.
.	.	.	.	.	.	.	r	.	.	.	+	c	c	+	+	+	.	+	.	+	.
.	r	r	r	r	r	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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.	rr	r	r	r	r	r	+	+	c	ccc	cc	cc	+	+	.	+	c	c	+	cc	+
r	rr	.	r	r	r	r	.	.	.	.	.	.	r	.	.	r	r	.	.	r	r
.	.	.	.	.	.	.	.	.	r	+	r	.	c	+	c	.	.	.	r	.	rr
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.	r	rr	rr	+	c	c	c	r	.	.	.	+	r	.	.	.	.	r	.	r	.
r	c	+	r	r	r	r	.	.	.	.	.	.	.	.	.	.	.	c	r	r	+
.	.	rr	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r
cc	ccc	ccc	ccc	cc	+	+	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.
+	.	+	.	c	+	.	.	.	.	.	.	r	r	r	.	+	.	.	r	+	c
r	.	.	.	.	.	.	.	.	.	.	.	c	c	+	c	cc	cc	cc	cc	c	c
r	.	cc	ccc	ccc	cc	c	cc	.	.	.	.	.	.	.	.	.	.	c	c	r	+

Month	I	I	I	II	II	II	III	III	III	III	III	IV	IV	IV
Date	2	10	30	9	15	22	1	8	11	21	29	1	7	13
Temp.	3,70	3,65	—	—	2,10	2,45	1,95	1,80	—	—	2,10	—	3,95	3,40
Sal.	23,58	25,95	—	—	26,27	27,34	22,62	26,94	—	—	22,48	—	27,22	24,04
C. debilis Cl.	.	.	.	.	*c*	*c*	*c*	+	*c*	*c*	*c*	+	*r*	*r*
C. decipiens Cl.	.	*r*	*r*	+	+	*c*	.	+	*c*	+	+	+	+	.
C. diadema Ehb.	*r*	.	.	*r*	.	.	+	*r*	+	+	+	+	*r*	*r*
C. didymus Ehb.	.	.	*r*	.	.	.	*r*	+	.	.	.	.	.	.
C. hiemalis Cl.	.	.	.	.	.	.	.	.	.	.	+	*r*	*c*	*r*
C. Schüttii Cl.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
C. scolopendra Cl.	.	.	.	*r*	*r*	*r*	.	*r*	.	*r*	.	*r*	.	.
C. socialis Lauder	.	.	.	+	*c*	+	+	+	+	.	.	.	.	.
C. teres Cl.	.	.	*r*	.	.	.	*r*	.	*r*	.	*r*	.	*r*	.
Coscinodiscus concinnus W. Sm.	+	+	*r*	.	*r*	.	.	*r*	.	.	.	.	.	.
C. oculus iridis Ehb.	.	.	+	*c*	.	+	*r*	*r*	.	.	.	.	.	.
C. polychordus Gran.	.	.	.	.	*r*	*r*	+	.	.	.	*r*	.	*r*	.
Ditylum Brightwellii West.	.	.	.	.	.	.	.	.	.	.	.	.	*r*	.
Guinardia flaccida Castr.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leptocylindrus danicus Cl.	.	.	.	.	*r*	.	*r*	*r*	*c*	*r*	+	.	*r*	*r*
Nitzschia seriata Cl.	.	.	.	.	*r*	*r*	*r*	*r*	*r*	+	+	*r*	+	*r*
Rhizosolenia delicatula Cl.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
R. gracillima Cl	.	.	.	.	.	.	.	.	.	.	.	.	.	.
R. semispina Hensen	*rr*	.	*r*	.	.	.	.	.	.	*r*	.	*r*	*r*	*r*
R. setigera Btw.	.	.	.	.	.	.	.	.	.	.	*r*	*r*	*r*	.
Skeletonema costatum Grev.	*rr*	*r*	*r*	*r*	*r*	*r*	*r*	.	.	*r*	*r*	*r*	.	.
Thalassiosira gelatinosa Hensen	.	.	.	*r*	*r*	*r*	*r*	.	.	.	*r*	*r*	*r*	.
T. gravida Cl.	.	.	.	*r*	*r*	+	.	*r*	.	*r*	*r*	.	*r*	.
T. Nordenskiöldii Cl.	.	.	*r*	*c*	*cc*	*cc*	*c*	+	+	+	*r*	.	.	.
Thalassiothrix Frauenfeldii Grun.	*r*	.	.	+	*c*	*cc*	*cc*	*ccc*	*cc*	*ccc*	*cc*	*cc*	*c*	+
T. longissima Cl. & Grun.	*rr*	*r*	.	*c*	*c*	.	*r*	*r*	.	*r*	*r*	.	*r*	.
Plankton-type	*Tp*	*(Tp)*	*Tp* *Nh*	*Tp* *T* *Si*	*(Tp)* *T Ns* *Si*	*Si* *Ns* *(C)*	*Si* *Ns*	*Ns*	*Ns*	*Ns*	*Ns*	*Ns*	*Ns* *(Nm)*	*Ns* *(Nm)*

IV	IV	V	V	V	V	VI	VI	VII	VII	VIII	VIII	VIII	IX	IX	X	X	X	X	XI	XI	XI
20	25	1	10	16	27	4	10	6	26	8	15	24	3	21	1	10	21	28	7	14	27
3,25	—	5,95	8,30	8,45	10,10	11,45	16,5	15,55	14,80	14,65	15,30	17,10	14,70	14,10	—	—	8,10	8,65	8,35	7,10	4,85
25,28	—	19,78	18,61	22,22	20,29	20,43	19,56	18,83	24,32	24,58	23,59	19,66	30.10	27,01	—	—	22,60	22,56	25,83	18,78	23,05
+	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
c	.	+	+	*r*	+	.	.	.	.	.	.	.	.	.	*r*	.	.	.	.	.	.
+	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	*c*	+	*c*
.	.	.	.	.	.	.	.	.	.	.	.	*c*	*r*	*ccc*	+	*cc*	*c*	+	.	.	.
+	+	+	+	*c*	+	.	*r*	.	.	.	.	*r*	.	.	.	*r*	*r*	*r*	*r*	.	*r*
.	.	.	.	.	.	.	.	.	.	.	.	*c*	*c*	.	+	*c*	*c*	*c*	.	+	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*r*
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.		*rr*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.		.	.	.	.	.	.	.	.	.	.	.	*r*	.	*r*	.	.	*r*	*r*	.	*r*
.		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*r*
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*r*	*r*	*r*	*r*
.	.	.	.	.	.	*r*	.	*r*	.	.	.	.	*r*	*r*	.	.	.	+	*r*	*r*	*r*
r	*c*	*c*	+	*c*	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	
r	*r*	.	.	*r*	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	*r*	.	.	*r*	*c*	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	+	*r*	*r*	*r*	*c*	*c*	*cc*	*ccc*	*ccc*	.	.	*c*	*r*	+	.	+	+	+	*c*	*r*	*c*
r	*c*	+	+	*r*	*c*	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*r*	+	*rr*	*r*
r	.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	*cc*
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*rr*	*r*	*r*
.	*r*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*rr*
cc	*cc*	*c*	*c*	*c*	*cc*	*c*	*c*	.	.	.	.	.	.	.	.	.	.	.	*c*	+	*c*
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Ns *C*	*Ns* *(Nm)*	*Ns* *Nm*	*Nm* *Ns*	*Nm* *Ns*	*Ns* *Nm*	*Ns*— *Nm*	*Nm* *(Ns)* *(Tp)*	*Nm* *(Tp)*	*Nm* *(Tp)*	*Tp*	*Tp*	*Nm* *(Tp)*	*Nm* *(Tp)*	*Nm* *(Tp)*	*Nm* *(Tp)*	*Nm* *(Tp)*	*Nm* *(Tp)*	*Nm* *Tp* *(Ns)*	*Nm* *(Tp)* *Ns*	*Ns* *Tp*	*Ns*

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